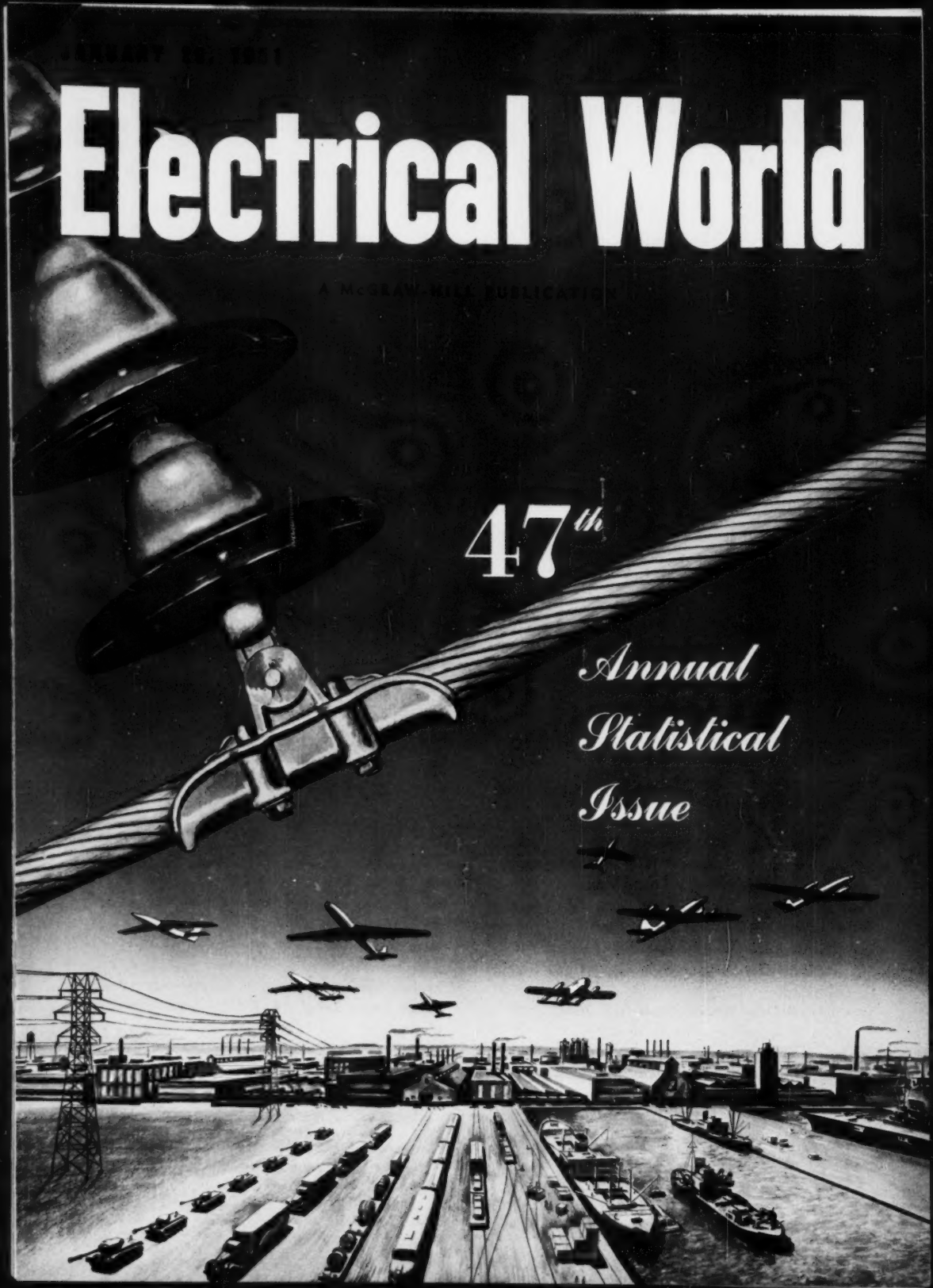
JANUARY 28, 1951

Electrical World

A McGRAW-HILL PUBLICATION

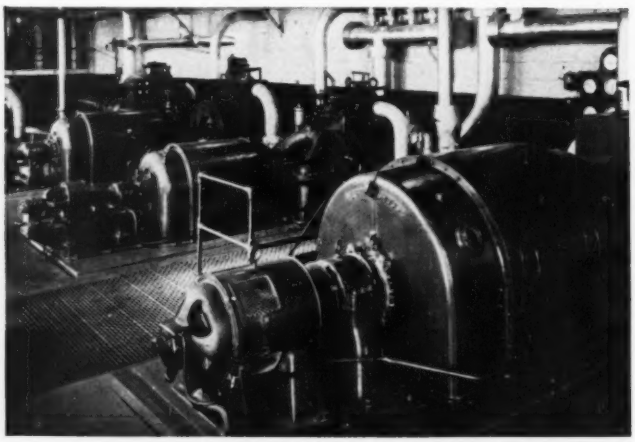


47th

Annual Statistical Issue

Plain talk about ADDITIVES...

and the better turbine oil performance you get with TEXACO REGAL OILS (R&O)



You can't make a silk purse out of a sow's ear, nor a good turbine oil out of a poor one by the use of additives. Additives may "soup up" a poor oil temporarily, but the effect soon wears off.

Texaco Regal Oils were outstanding turbine lubricants for many years before rust- and oxidation-inhibiting additives came into use. *With* these additives, *Texaco Regal Oils (R & O)* are even better. Their resistance to oxidation is some 20 times greater, their ability to give long-lasting protection against rust is vastly increased.

In addition, *Texaco Regal Oils (R & O)* are specially processed to increase their basically excellent anti-foaming properties. All this adds up to a greater margin of safety for turbines . . . greater assurance of clean lubricating systems, full bearing protection, instant governor response . . . throughout an extra-long oil service life.

A Texaco Lubrication Engineer will gladly explain in detail the specific benefits *you* can expect from the use of *Texaco Regal Oils (R & O)*. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

Reporting The AIEE

Industrial Marketing magazine stages an annual editorial competition in which some well-known authorities pass judgment on the editorial efforts of a great many business papers.

Last year, Electrical World won an Award of Merit for its coverage of the AIEE's Winter General Meeting. (See cut below).

We've scheduled the same thorough method of reporting to cover this year's meeting. For you who cannot attend the sessions (Jan. 22 to 26 at Hotel Statler in New York) Electrical World will give you a careful condensation of all the papers of importance to you, as well as a report of the discussions which follow. A few hours in its pages will give you the substance of facts brought out in a week of discussion.

We'll be present and busily taking notes at 40 separate sessions. Our total job means making clear condensation of 157 learned papers and reporting the discussions they stimulate.

All of Electrical World's New York technical and news editors will be assigned to the meeting—and our West Coast editor will also be on hand to help out.

We'll have two cameramen hard at work during Monday's registration period and before and after the first general session.

So, if you're too busy these busy days to attend this year's gathering, you'll want to read the next issue of Electrical World carefully for all that took place. And if you do attend, you'll probably want to save this issue as a permanent record of the Winter General Meeting.

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing applying electric power

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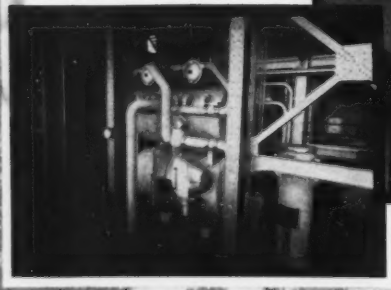
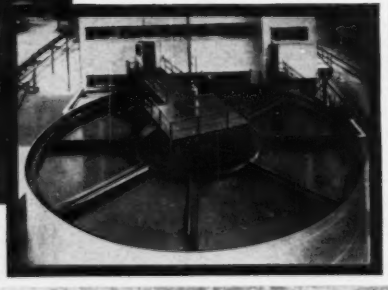
COCHRANE

88 YEARS OF SERVICE

PIONEER AND LEADER IN METHODS AND APPARATUS FOR COMPLETE CONDITIONING OF BOILER FEED, PROCESS AND INDUSTRIAL WATER SUPPLIES





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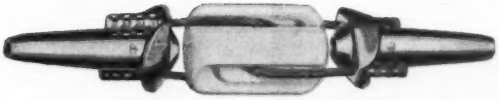
In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

Electroline Automatic Insulating Line Splice SECTIONALIZERS

2200 AND
2300 SERIES



2500 SERIES

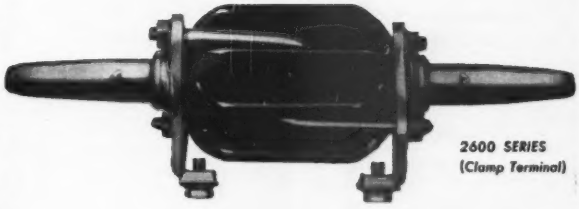
These Automatic Insulating Line Splice Sectionalizers offer a large number of line applications —at the lowest possible cost. You'll find these Electroline Sectionalizers ideal for

- **REGULATING SECONDARY VOLTAGES**
  Facilitates secondary voltage regulation when used to bank transformer secondaries.
- **FUSING TRANSFORMERS**
  Gives transformers real protection when used to fuse transformer leads.
- **SECTIONALIZING NETWORKS**
  Suitable for sectionalizing networks to isolate the area in trouble.
- **SERIES STREET LIGHTING**
  Simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.

The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor size for which they are adapted.

The wet process porcelain insulators used in the 2500 and 2600 series sectionalizers can, if desired, be furnished with a white glaze to reflect the beam of the lineman's searchlight when locating trouble at night.

2500F SERIES



2600 SERIES
(Clamp Terminal)

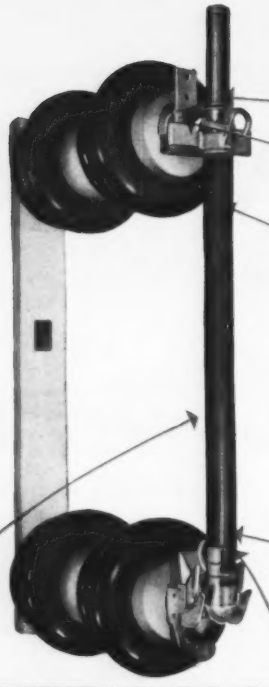
2600 SERIES
(Connector Terminal)

Send for New Bulletin

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois • IN CANADA—POWERLITE DEVICES, LTD., TORONTO

6 Good SMD-2 POWER



High Interrupting Capacity
(Up to 1,000,000 KVA)

Compressed Boric Acid

Movable Arcing Rod

Vulcanized Fibre Liner (for added impact strength)

Laminated Bakelite Tube

1.

High Recovery Voltage Withstand Ability

—because stress cones distribute transient high frequency voltage stress that occurs immediately after arc interruption and before drop-out.

Lower Stress Cone

2.

Permanent Accuracy of Time Current Characteristics

...because fusible element is non-damageable.

For example:

Low Current Fusible Element of nickel-chrome, pretensioned.

Series of Levers —approx. 150-1 ratio — reduces drive spring pull to correct degree for pretensioning of hair-like fusible element.

3.

✳ **FULL COVERAGE PROTECTION IS:** the new concept of transformer fusing in which:

A primary fuse is applied for both primary short circuit and secondary back-up short circuit protection.

A fuse is expected to perform dependably regardless of type of system; type of fault current; type of application; or system and atmospheric conditions.

✳ **FULL COVERAGE PROTECTION PROVIDES**—along with the above protection—savings in operating expense by:

Eliminating the need for replacement of "suspect" fuses on other phases when one fuse blows.

Eliminating the need for periodic replacement of fuses to prevent "sneak-outs" caused by vibration- or age-weakened fusible elements.

✳ **FULL COVERAGE PROTECTION REQUIRES:** dependable high and low fault-current interrupting ability;

protection against dielectric breakdown or external flashover from severe recovery voltage;

a fine degree of accuracy in time-current characteristics;

a "non-damageable" fusible element which cannot be injured by surge currents, vibration, or aging;

a choice of time-current characteristics to provide flexibility in coordinating with other primary, and with the secondary, protective devices.

S&C ELECTRIC

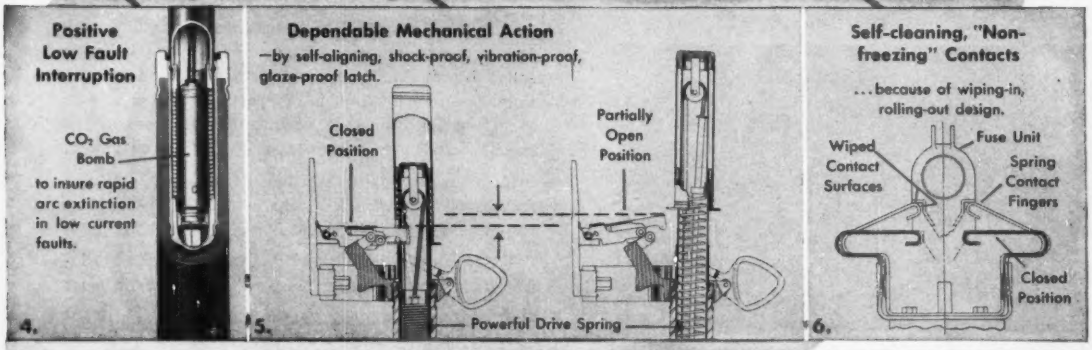
Formerly SCHWEITZER & CONRAD,

Reasons Why FUSES GIVE YOU Full Coverage* Protection

Featured here are some of the design reasons why the SMD-2 Power Fuse can be used, within its interrupting capacity, for *any* fusing application, at *any* point on your system. It is especially recommended for economical and reliable protection of stations tapped directly on high lines.

Fusible elements for the SMD-2 are made in a range of speeds, so reclosing breakers can be coordinated with the fuses to clear transient faults. Time-current characteristics are accurate and enduring, guaranteeing that coordination will be permanent.

If your protection problem involves severe recovery voltage, critical coordination, extremely low or extremely high fault current, the SMD-2 Drop-Out Power Fuse is the solution.



For a complete explanation of these and other distinctive features, ask for our new Catalog Section 262

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S&C Electric Company, Chicago

Mail immediately a copy of your new Catalog Section 262

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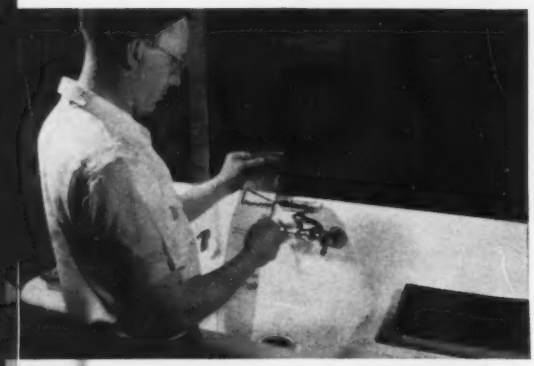
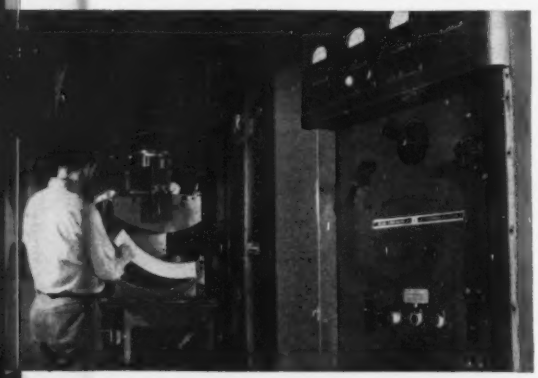
COMPANY 4421 Ravenswood Avenue Chicago 40, Illinois, U. S. A.

INC. In Canada, Powerlite Devices, Limited, Toronto

CORONA-FREE DESIGN KEEPS TRANSFORMERS YOUNG



1 J. H. MORAN CHECKS oscillogram after impulse test on the 40,000 kva transformer. Cathode ray oscillograph spots slightest trace of corona . . . yet even five times normal voltage showed no detectable corona discharge.



2 DIELECTRIC HEATER quickly dries fuller board insulation as it is pressed into accurate shape. Snug fit around coils and conductors eliminates air pockets and replaces free space with corona-resisting material in critical areas.

3 PROPERLY DESIGNED insulation raises corona and breakdown levels. This assembly floor scene shows fuller board washers and coils made up in pairs. Static shields at left center help transformers withstand high stresses.

Surge Protected Transformers for Philadelphia Electric Co. Will Retain Full Impulse Strength After Years of Use

WHY DO TRANSFORMERS fail? One important cause is corona discharge. Corona eats at transformer insulation, scoring it, making it electrically conducting. As a result, reduced transformer impulse strength causes dangerous flashover.

Allis-Chalmers corona-free design removes effects of corona.

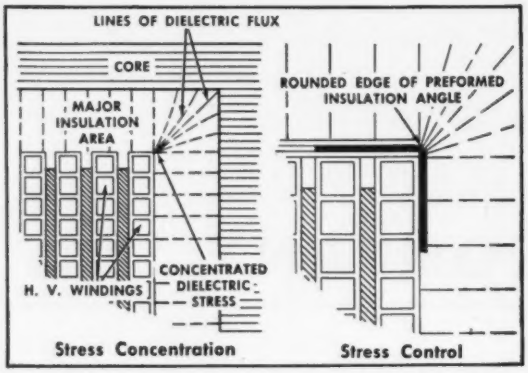
How was it done? By designing dielectric shields on contacts to reduce flux concentration. By improving insulating materials and properly contouring press-molded fuller board. Corona-resisting material is inserted in critical areas next to high voltage conductors. Calculating boards are used to make windings corona-free at maximum voltage conditions.

Did these design changes pay off? Tests show that transformers with corona-free construction stand up after repeated surges without slightest signs of deterioration.

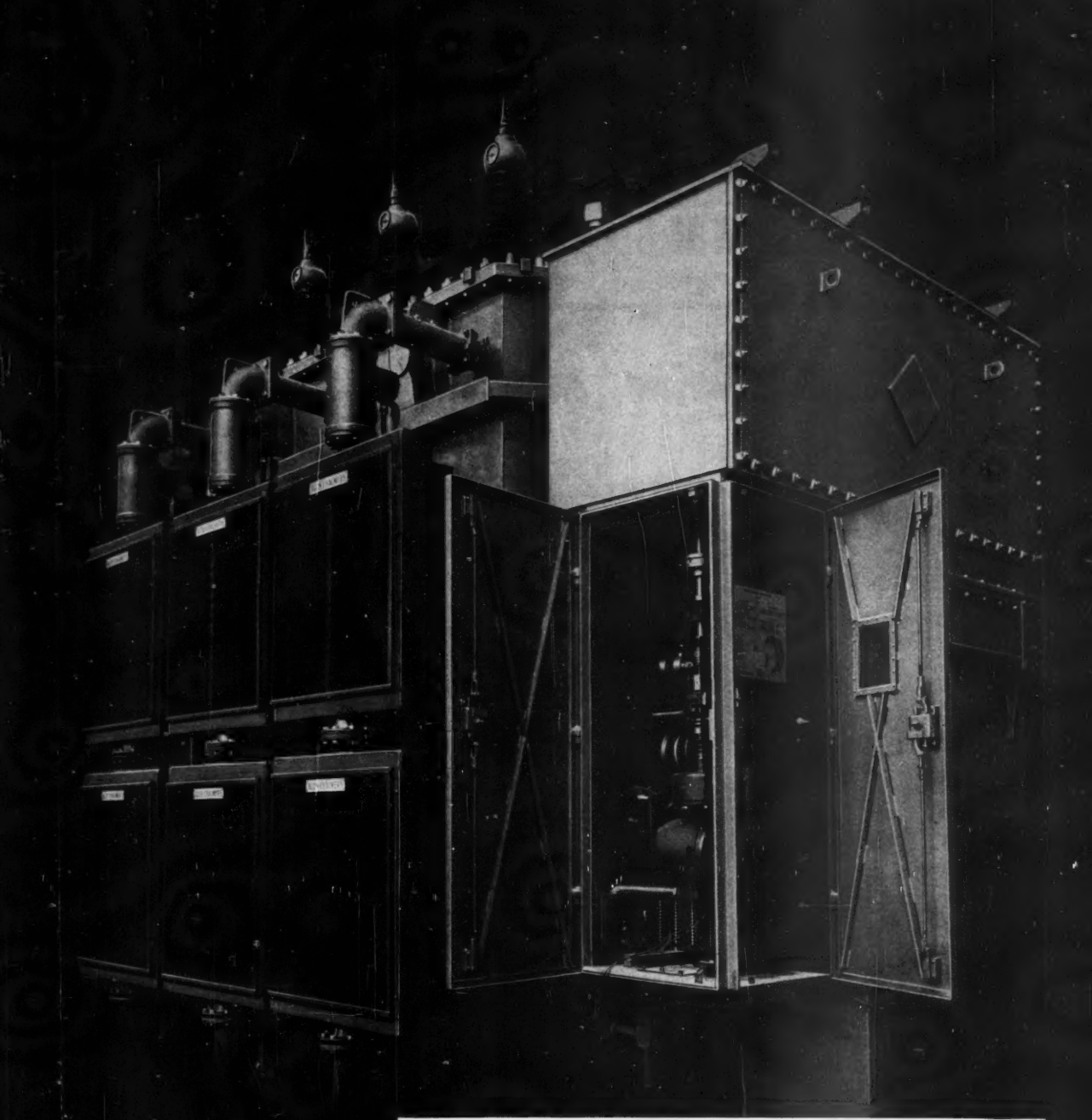
Today you can obtain the kind of transformer that maintains its full strength . . . one that will last for years without growing old.

A-3210

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



4 PRINCIPLE OF FITTING insulation right up next to areas of high dielectric stress, then reducing stress per unit area with rounded surfaces, is one of the methods used by Allis-Chalmers engineers to cut corona discharge.



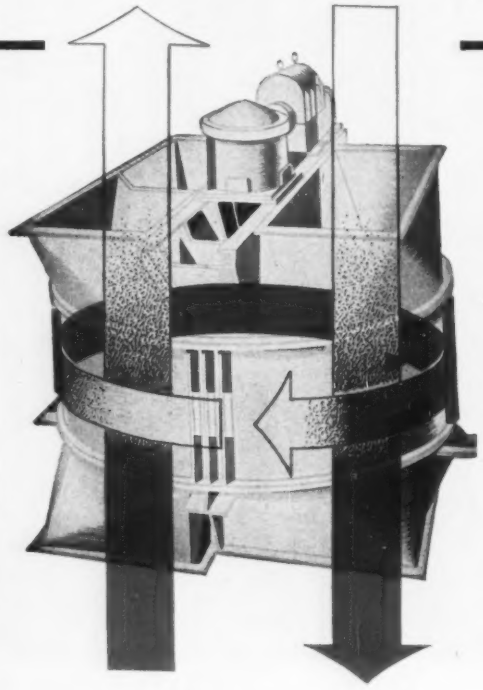
ALLIS-CHALMERS

5 BUILT FOR LONG LIFE this 40,000 kva forced-oil-cooled power transformer is rated 69,000 volts delta, 36,750 volts grounded Y, with plus and minus 15% regulation in neutral using type TLB load ratio control. The electro-cooler is completely self-contained with two power sources for pump and fan.

more than 200,000,000 lbs/hr of post-war steam generating capacity

equipped with *Ljungstrom*

AIR PREHEATERS



Here indeed is impressive evidence of the wide acceptance of the Ljungstrom air preheater. Since the war the total capacity of steam generating units equipped with Ljungstrom air preheaters, installed, under construction or on order in industrial and utility plants throughout the country comes to well over 200,000,000 lbs of steam per hr.

The reasons for the steadily increasing preference for the Ljungstrom air preheater are simple enough. The continuous regenerative counterflow principle assures maximum heat transfer with minimum weight and size. Flexible and compact, it may be used in a wide range of applications. Its proven reliability and low maintenance eliminate costly shutdowns.

If you are planning to build a new plant or modernize an old one, investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid in effecting the most economic heat recovery from flue gases.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42d STREET • NEW YORK 17, NEW YORK

Again, America's electric utilities must plan to meet increased demands for power despite shortages of men and material. Only by the most efficient and economical maintenance of existing lines can this challenge be met. For 32 years, Hoosier has dependably and economically served utilities in meeting every type of power demand and emergency. This nation-wide organization of experienced engineers, trained men and special equipment is ready to serve you for immediate or future planning . . . call in Hoosier now.

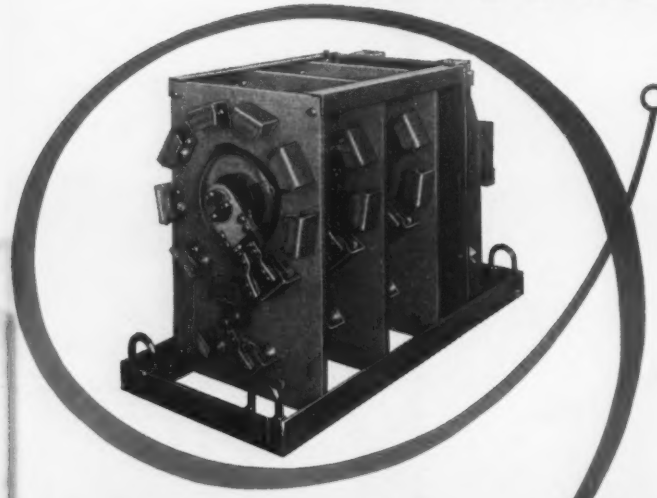
HOOSIER *Engineering Company*

1384 HOLLY AVENUE • COLUMBUS 8, OHIO

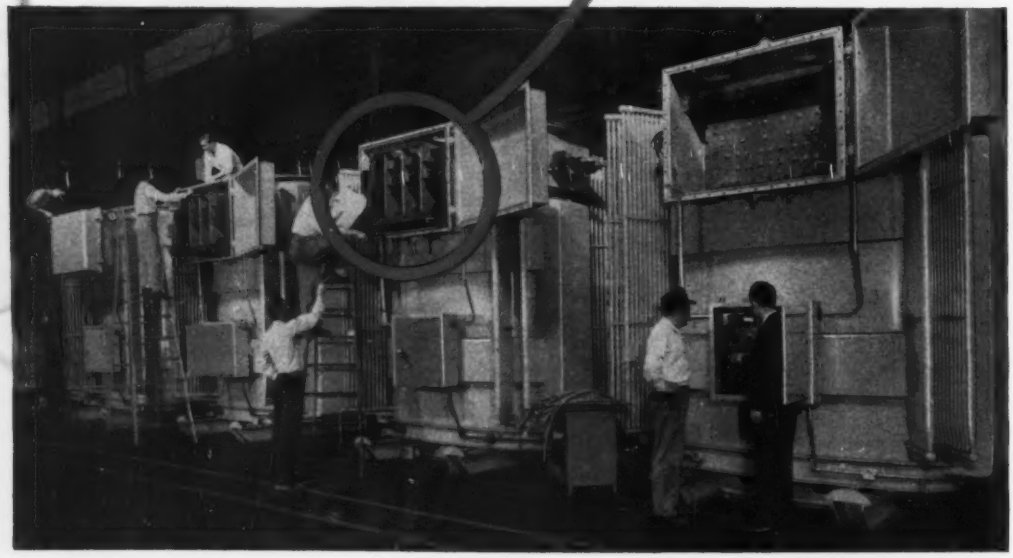
ERECTION AND MAINTENANCE OF TRANSMISSION LINES

PENNSYLVANIA TRANSFORMER COMPANY

Introduces



for Pennsylvania Load Ratio Control Transformers, Step Voltage Regulators, and Integral Unit Substations.



Pennsylvania TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

*PENNSYLITE

An outstanding, new, low power factor, low loss dielectric material, developed expressly for Pennsylvania Underload Tap Changers.

WHAT IS PENNSYLITE

Pennsylite is a low power factor, low dielectric loss, laminated material developed expressly for the panels in the switch assemblies of Pennsylvania's 16 and 32 step Underload Tap Changing Equipment.

WHY WAS PENNSYLITE DEVELOPED

It is no secret that difficulty has been experienced with existing fabric base and paper base laminates. Most of this difficulty has been traced to entrapped gas sealed within the cured laminated structures. These gas voids increased the power factor and dielectric loss of the laminates and resulted in laminates having erratic voltage strength. Under electrical stress, voltage found its way through the void structures parallel to the laminations destroying the insulating value of the laminates.

PENNSYLITE ELIMINATES THIS PROBLEM

Pennsylite combines the best electrical properties of low loss paper-base laminates and the best mechanical properties of fabric-base laminates.

A specially treated, fine weave fabric and low loss thermal setting resin binder make Pennsylite a homogeneous laminated structure free of gas voids.

NO VISIBLE DIELECTRIC FATIGUE

A 60 cycle, 90 KV voltage was applied continuously to Pennsylite step voltage regulator panels for a period of several days. No disturbances or failures resulted. Radio Influence Voltage Tests indicated exceedingly low microvolt levels, showing that ionization leading to corona was not evident.

WHAT ARE THE OUTSTANDING QUALITIES OF PENNSYLITE

1. Low 60 cycle power factor (1.5 to 4% at 20°C.) when received from supplier.
2. Ability to withstand test voltages continuously applied parallel to laminations for an extended period of time.
3. Will not delaminate or split parallel to laminations when exposed to 120°C. continuously.
4. High impact strength perpendicular and parallel to the laminations.
5. High flexural, tensile, and bond strength.

WHAT MAKES THIS NEW DEVELOPMENT OUTSTANDING

Mechanically, existing paper-base laminates are weaker than existing fabric-base laminates. But, as a rule, the electrical properties are poorer for fabric-base laminates than for paper-base laminates. In Pennsylite the best electrical properties of low loss, resin bound paper-base laminates are combined with the best mechanical properties of fabric-base laminates.

*Trademark

TO ASSURE UNIFORM DIELECTRIC QUALITY, *specifications for evaluating Pennsylite have been adopted by Pennsylvania Transformer Company and accepted by the suppliers as a standard prodedure for evaluating this new laminate.*

PROCEDURE FOR EVALUATING PENNSYLITE

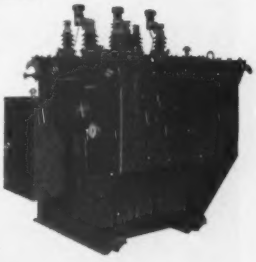
1. Measure power factor at 60 cycles, 20°C.
2. Heat in dry oven for 36 hours at 250°F. (121°C.) to check for possible blistering or delaminating.
3. Measure power factor at 60 cycles. Compare with (1). Power factor must be within prescribed tolerances.
4. Mount 2 studs (½" Dia) 3½" apart on a section of Pennsylite, and immerse in transformer oil 78°to 82°C. for one hour.
5. Evaluate parallel to lamination voltage strength by applying 60 cycle voltage and obtaining audible and visual corona points, withstand KV and breakdown KV.
6. Check dielectric fatigue. Apply test voltages continuously for several days duration.

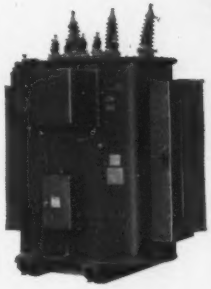
NOTE: *Each piece of Pennsylite is given a 60 cycle voltage power factor test before it is fabricated for use into a Pennsylvania Underload Tap Changer.*

YOU'LL FIND PENNSYLITE AND MANY OTHER DESIRABLE FEATURES IN PENNSYLVANIA

Step Voltage Regulators

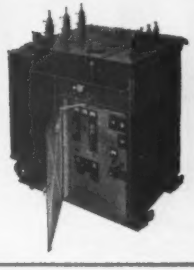
156 Kva Step Voltage Regulator. 12000 Volts. 32-⅝% taps. Total tap range plus or minus 10%.





Load Ratio Control Transformers

2500 Kva, 3 Phase, 66000-2500/4330Y x 7500/-12990Y Volts. Low Voltage winding equipped with 16-15/16% taps for automatic tap changing under load.



Integral Unit Substations

1500 Kva Single Circuit Unit Substation. High Voltage: 22000 Volts. Low Voltage: 4160 Volts. 32-⅝% taps on Low Voltage winding.

V.C. CABLE

Roebling Varnished Cambric is your A-1 specification for heat resistance

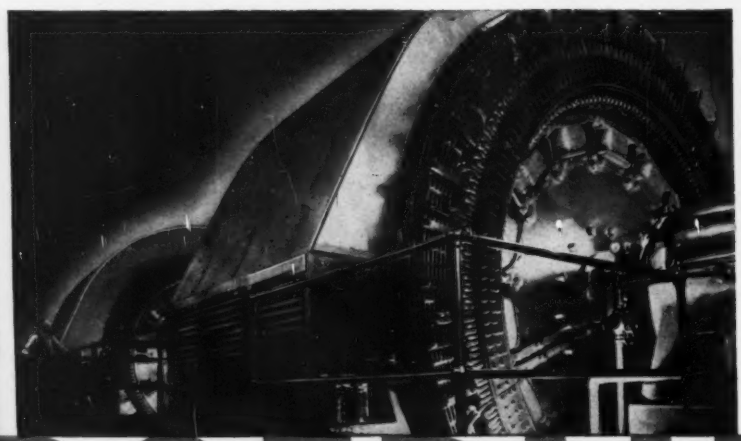
YOU'LL GET maximum dependability... you'll save real time and money... by adopting Roebling V. C. Cable as leads for transformers, generators, motors and oil switches... Roebling V. C. is furnished in single conductor sizes from 2,000,000 C.M. to #14 A.W.G.; in multiple conductor sizes from 750,000 C.M. to #14 A.W.G. It is recommended for use up to 17,000 volts between phases in single or multiple conductor construction; and to 26,000 volts for single conductor grounded neutral.

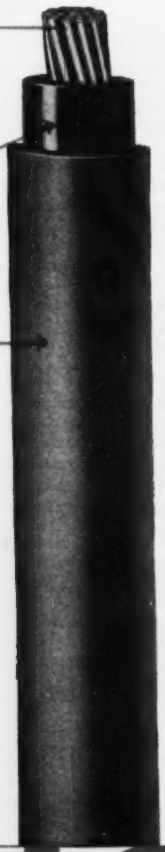
A big share of Roebling's complete line of electrical wires and cables is required today in the nation's rearmament program, but we shall do everything possible to meet your requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

Manufactured with solid conductors or stranded in a variety of strandings, coated or uncoated, according to your needs. Available in single or multiple conductor.

Insulated with varnished cambric tape, in accordance with I.P.C.E.A. and Underwriters' specifications unless otherwise specified by you.

For outside covering you have a choice of braid, for service in dry locations; lead, for service in damp locations; and for aerial use or direct burial we recommend a protective armor such as steel tape or galvanized round wire armor.





ROEBLING

Atlanta, 934 Avon Ave ★ ***Cambridge,*** 31 Carleton St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St

For Added PROTECTION
to the LINEMAN

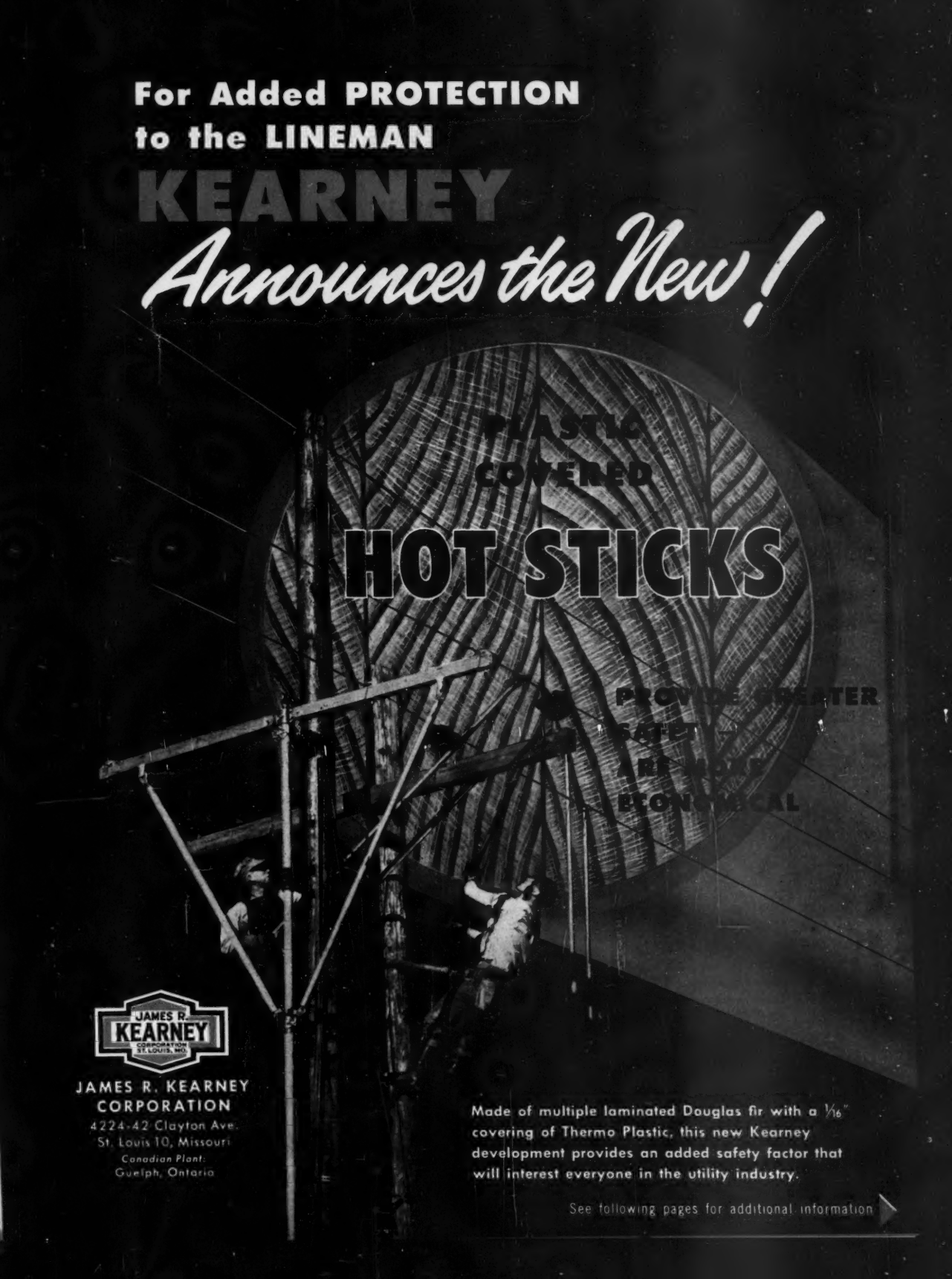
KEARNEY

Announces the New!

PLASTIC
COVERED

HOT STICKS

PROVIDE GREATER
SAFETY
ARE MORE
ECONOMICAL



JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave.
St. Louis 10, Missouri
Canadian Plant:
Guelph, Ontario

Made of multiple laminated Douglas fir with a 1/16" covering of Thermo Plastic, this new Kearney development provides an added safety factor that will interest everyone in the utility industry.

See following pages for additional information

WORK ENERGIZED LINES THE SAFE MODERN WAY

with

KEARNEY PLASTICKS

THEY'RE NEW
THEY'RE BETTER

MODERNIZATION SERVICE

If your live line tool fittings are in good repair, Kearney will install new Plasticks in them in order that you may take advantage of this new safer method. Cost is nominal. Write for complete cost information.

Developed after three years of constant experimenting and testing, the Kearney plastic covered hot stick is the only major improvement made in live line tools in years. There are many advantages to KEARNEY PLASTICKS.

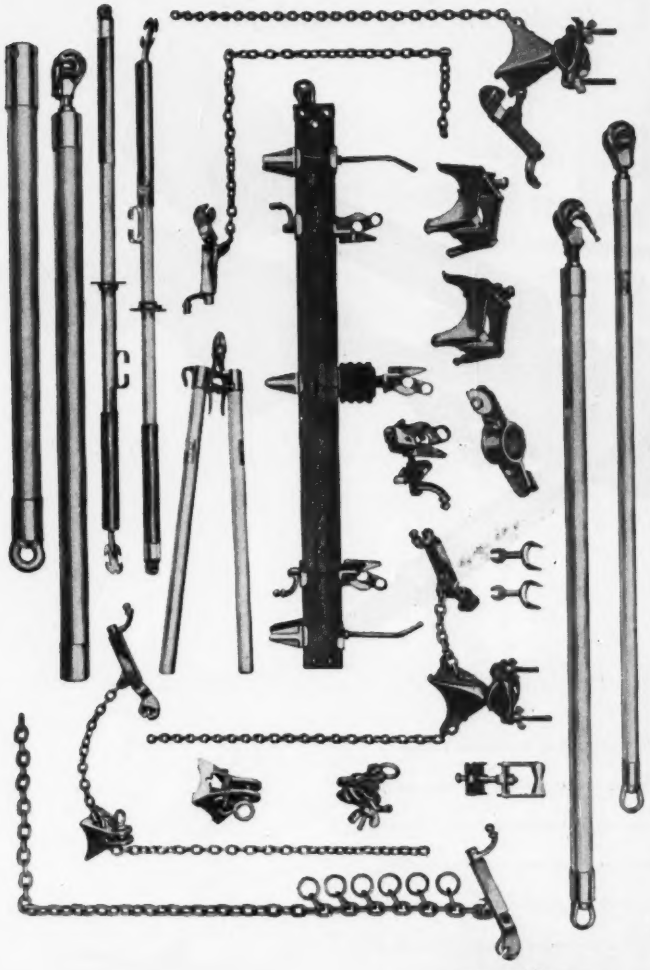
JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave.
St. Louis 10, Missouri
Canadian Plant:
Guelph, Ontario

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

Here are a few:

- Safer Insulation
- Higher Voltage Tests
- More Economical
- More Resistant to Damage

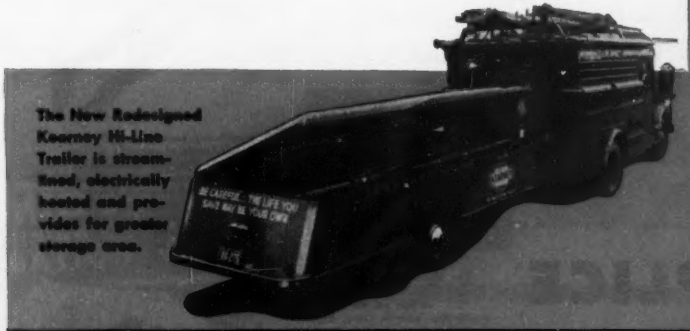
Better Construction— *SAFER* Maintenance



KEARNEY
LIVE LINE TOOL SET

Here's What You Get

Qty.	Cat. No.	Description
1	4800-6	Side Arm, 9' long—less fittings
4	4800-31	Conductor Holders
1	4800-32	Insul. Cond. Holder Assembly
2	4800-33	Line Guard Assemblies
1	4800-4	Side Arm Attachment
1	4657-3	Lift-Pol, 2.5" x 18', spliced
1	4656-1	Lift-Pol, 2" x 10'
1	4655-6	Han-Pol, 1.5" x 10'
1	1729-1	Pol-Band, 2.5"
1	4760-26	Brace Bracket Assembly
2	4760-5	Pol-Grips, 1.25" to 3"
2	4760-7	Pol-Grip Extensions
1	1846	Chain Rope Hitch
2	1855-4	Combination Tie Sticks
1	4773-1	Insulated Pliers, 1.25" x 5' oak
2	7481	Lift-Pol Snubs
2	4455-17	Fit-On Tie Heads



The New Redesigned Kearney Hi-Line Trailer is streamlined, electrically heated and provides for greater storage area.

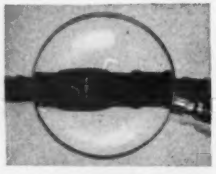
Better Construction— *SAFER* Maintenance

BURNDY-BUILT *to do an important job* BETTER

HYSPLICES . . . Overhead line splicing is expensive to do . . . expensive to do over. That's why so many utilities are now adopting the latest, most efficient line splicing method—the Burndy Hysplice. If you have not as yet, investigated the new Hysplice method, we urge you to call in the Burndy Representative for a brief, interesting demonstration. You will be under no obligation at all. Ask for Catalog HS51, listing tools, dies and sleeves for copper, copper weld, aluminum, A.C.S.R., Amerductor and steel.

Hysplicing speed and efficiency is the result of sensible tooling. Quickly, Hysplice sleeves are installed with a 9 lb. hydraulic Hypress that exerts a 9 ton force; illustration top of page. Simple manual tool (above) or foot, air and electrically operated tools can be supplied too.

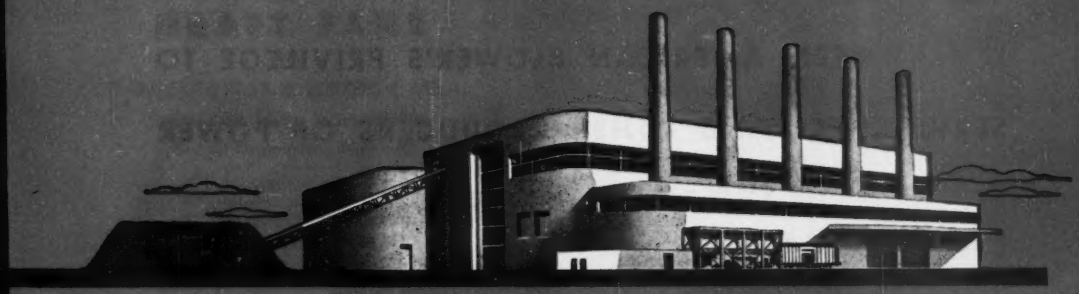
BURNDY
HYSPLICE



The circular indents of the Hysplice provide a snubbing action on the cable. Under the indents, hard, high conductivity beryllium-copper particles are forced into the conductor and sleeve, keying the two together.

41 *Burndy, New York 54, N. Y. • Western Branch: Vernon 58, Calif. • Burndy Canada Ltd., Toronto 8, Ontario*

Unequalled Piping Experience



PIPING FOR MORE THAN

3,400,000 kw

of Central Station Capacity

has been fabricated and erected by*

MIDWEST

Since 1945

*Including Projects Now Under Construction or on Contract

MIDWEST PIPING SERVICE IS NATION-WIDE

4 Plants Are Better Than 1

PIPING FABRICATORS AND CONTRACTORS

MIDWEST PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.

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4195

IT HAS BEEN AMERICAN BLOWER'S PRIVILEGE TO SERVE THESE AND OTHER PRODUCERS OF POWER IN THE PUBLIC UTILITY FIELD

Buffalo Niagara Electric Corporation
Central Arizona Power & Light Company
Central Illinois Electric & Gas Company
Central Illinois Light Company
Columbus & Southern Ohio Electric Company
Connecticut Light & Power Company
Consolidated Edison Company of New York
Consumers Power Company
Consolidated Gas, Electric Light & Power Co. of Baltimore
Connecticut Power Company
Dairyland Power Co-operative
Dallas Power & Light Company
Detroit Edison Company, The
Duke Power Company
Eastern Shores Public Service Company
Fitchburg Gas & Electric Light Company
Florida Power Corporation
Florida Power & Light Company
Gulf Power Company
Hartford Electric Light Company
Indianapolis Power & Light Company
Iowa Public Service Company
Iowa-Illinois Gas & Electric Company
Iowa Power & Light Company
Iowa Electric Light & Power Company
Kansas City Power & Light Company
Kansas Power & Light Company, The
Kansas Gas & Electric Company
Long Island Lighting Company
Los Angeles, California, City of
Louisiana Power & Light Company
Madison Gas & Electric Company
Mississippi Power Company
Missouri Power & Light Company
Nebraska Power Company
North Carolina Power Company
Northern Indiana Public Service Corporation
Ohio Edison Company
Oklahoma Gas & Electric Company
Omaha Public Power District
Otter Tail Power Company
Pacific Gas & Electric Company
Pennsylvania Power Company
Philadelphia Electric Company
Potomac Electric Power Company
Public Service Company of Oklahoma
Public Service Electric & Gas Company
Public Service Company of Colorado
Southwestern Public Service Company
Southern Indiana Gas & Electric Company
South Carolina Power Company
Springfield, Illinois, City of
Tampa Electric Company
Texas Electric Service Company
Texas Power & Light Company
Tennessee Valley Authority
Virginia Electric & Power Company
Worcester County Electric Company of Massachusetts

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

DRAFT FANS

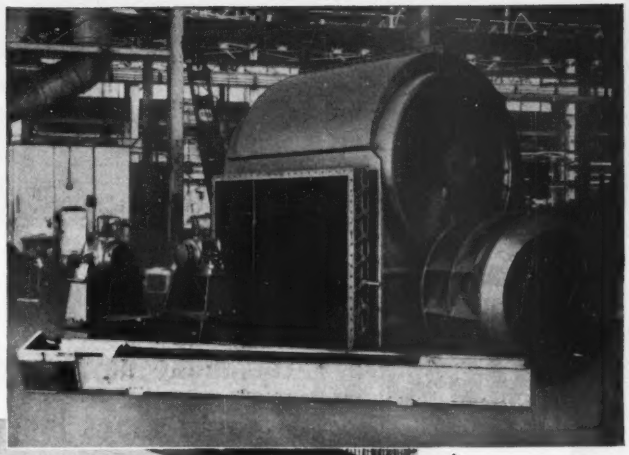
for

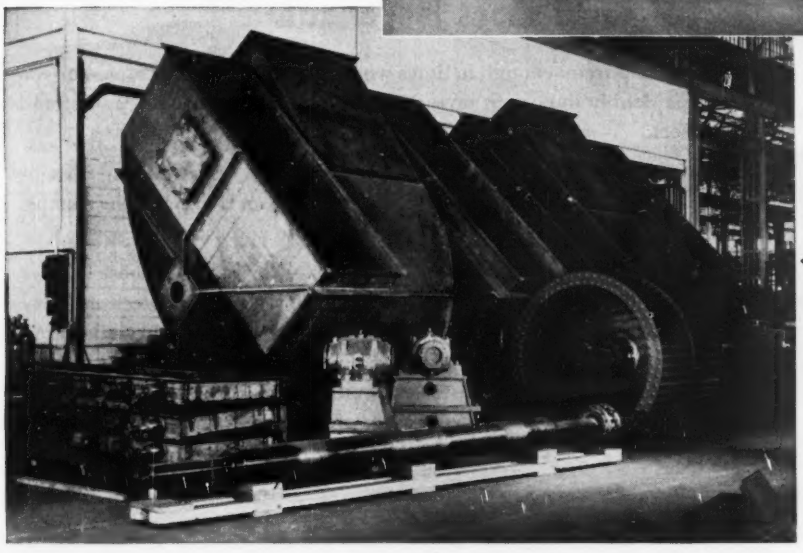
PACIFIC GAS & ELECTRIC CO.

Contra Costa Station at San Francisco

Bechtel Corporation, Engineers

To keep progress with ever-increasing demands for electrical horsepower, America's great public utilities are constantly expanding their plants and facilities and extending the scope of their services.





Above is shown one of the 6 American Blower Forced Draft Fans used on each boiler in the new Contra Costa Station. Each fan is 180,000 CFM at 100° at 18.2" static pressure.

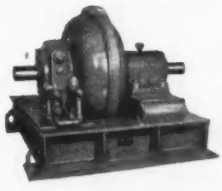
←**The photograph** at the left shows 2 of 6 American Blower Induced Draft Fans for the same station. Each has a capacity of 313,000 CFM at 420° at 10.1" static pressure. The new Contra Costa Station of the Pacific Gas and Electric Company will be used to supplement their very large hydro and steam generating electrical system.

That a vast majority of these utilities depend on us for important equipment, is a tribute to the fine performance of American Blower Products as well as to the engineering skill available through our strategically located branch offices.

May we serve you?

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



Gyrol Fluid Drives

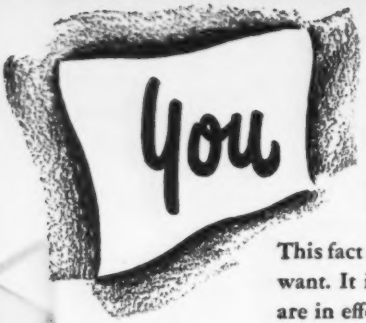
for Mechanical Draft Fans are also a part of American Blower's wide range of products which serve America's leading public utilities.

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

there are *no allocations* on

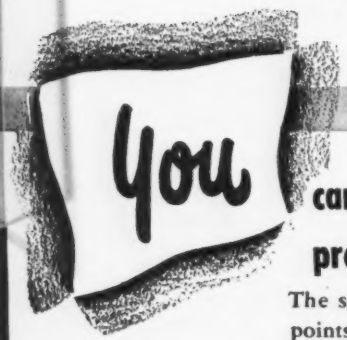


can make new conductor and strand last 3 to 10 times longer . . .

This fact is important enough in times when you can get all the conductor you want. It is doubly important now that allocations of conductor and strand are in effect.

It has been proved time and again, that conductors fail most frequently at support points . . . from vibration, from power arcs, from chafing in the clamps. Even mid-span failures may be caused by vibration and arc-over.

Preformed Armor Rods provide a positive means for reducing these failures to a degree not possible with any other means of conductor protection. They are backed by exhaustive tests in the Country's best equipped physical testing laboratories. They are installed on thousands of lines today. (Laboratory test reports and names of present users are available on request.) They cost far less . . . installed . . . than any other form of conductor protection.



can make splices and repairs at a fraction of your present costs . . . and save conductor in the bargain

The same tight-gripping action that PLP Armor Rods develop at support points makes them ideal for splices and conductor repairs. Splices made with PLP Armor Rods actually exceed the original conductor in tensile strength and current-carrying capacity.

Preformed Armor Rods are quickly applied. The average installation takes about 3 minutes. No sections of line need be cut out. No high clamping pressures are developed that might damage the underlying conductor. *Any* lineman, regardless of his skill, can make a perfect installation every time. RESULTS ARE PREDICTABLE WITH PLP ARMOR RODS.

armor rods today assure more operating conductor tomorrow

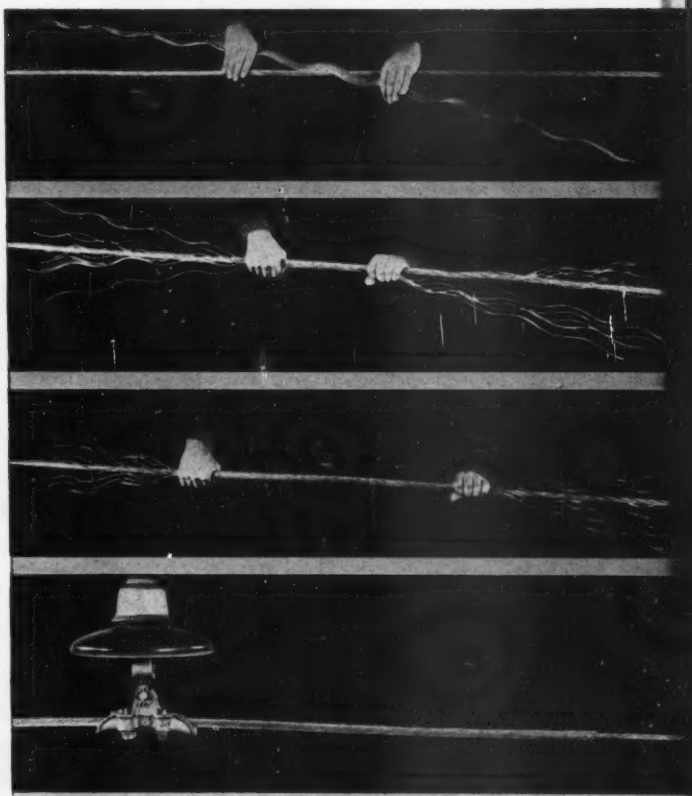
the *conductor you save!*

You can learn the technique of applying PLP Armor Rods in the time it takes to read this

Because PLP Armor Rods are preformed, the only tools you need to apply them are your hands. If you can wring water from a cloth, you have mastered the motion needed. It is as easy as this:—

1. Take half to a full set of rods specified for the conductor you are working on. Place them across the conductor in the same direction as the lay of the conductor.
2. Grip the rods and the conductor in each hand and rotate in opposite directions. Just like wringing water from a cloth.
3. Repeat with the rest of the rods as above.
4. Continue the wiping action with the full set of rods until you have progressed to both ends of the rods. The ends will snap into place. No clips or clamps are needed to secure them.

You could make a perfect installation with what you have just learned. Like to try? We will gladly send you a sample set of PLP Armor Rods to examine thoroughly in your own office. Write on your company letterhead, to:—



PREFORMED

PLP

LINE PRODUCTS CO.

CLEVELAND 3, OHIO

*Preformed Armor Rods are for use under Patent No. 2,275,019 . . . other patents pending.

O. H. HUTCHINGS STATION
The Dayton Power and Light Company

SEWAREN GENERATING STATION
Public Service Electric and Gas Company

WHITE RIVER GENERATING STATION
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8 of the

PORT WASHINGTON STATION
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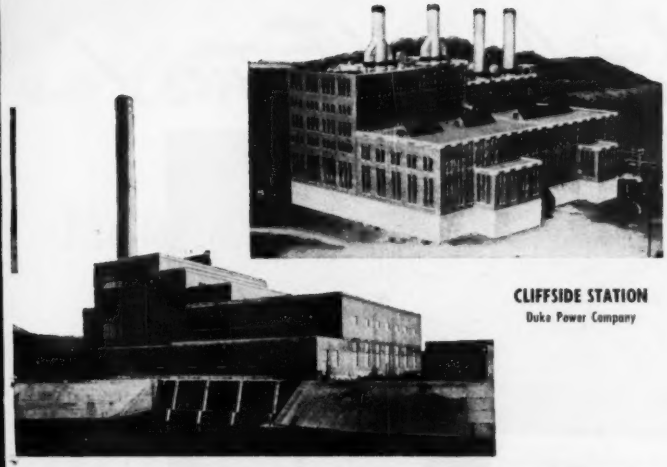
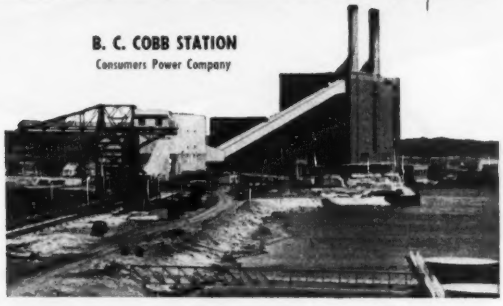
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

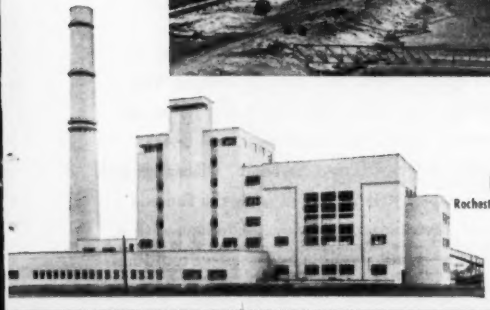


CLIFFSIDE STATION
Duke Power Company

top 10



B. C. COBB STATION
Consumers Power Company



RUSSELL STATION
Rochester Gas & Electric Corporation

In November 1950 the Federal Power Commission released a report entitled "Steam-Electric Plant Construction Cost and Annual Production Expenses for 1949."

Among other interesting and significant data were the "Average Btu per Kilowatt-hour Net Generation" of 245 steam-electric power stations reporting from all sections of the country. Eight of the ten stations having the *lowest* annual heat rates — as revealed by the report — are pictured on these pages.

All of the steam generating equipment in these eight stations was designed and built by Combustion Engineering — Superheater, Inc. B-461

— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

America's Most Admired Fixture!

Illumination PLUS
Point-of-Sale Merchandising
Wins New Friends for

Leader OFFICER

VL and NHC Series

LEADER VL-440 SPECIFICATIONS

Housing, channel and deep drawn end caps of 20 gauge steel, finished in white, high-gloss baked enamel. Extruded tubular side panels and moulded one-piece louver is of glowing white plastic that is warp-proof, colorfast, and destaticized. Louver swings down for easy servicing. Choice of 31° or 45° shielding. May be used as single units or in continuous runs—suspended or ceiling mounted. VL Series uses 2, 3 or 4 40-watt 48" T-12 lamps. Wired units include UL and ETL approved sockets, type FS easily replaceable starters and two high p.f. 2-lamp ballasts. Conventional 110-125 volts, 60 cycle A.C. Other voltages on request. NHC Series available for use with Slimline tubes and for 120, 200, 300 or 425 milliampere operation in lengths from 48" to 96".

You'll find this attractive fixture installed in the most tastefully decorated offices, stores and office buildings. The "Officer" not only adds to any decorative effect, but helps sell goods and services through appealing highlighting of floors, furniture and display sales material. The LEADER "Officer" is rich in construction, too. For example, it is provided with the famous LEADER one-piece louver of destaticized plastic . . . a louver with a multitude of small, rigid apertures—made possible by one-piece molding—to provide excellent shielding and soft, gracious light-diffusion.

Leader *America's No. 1 Lighting Equipment Manufacturer*

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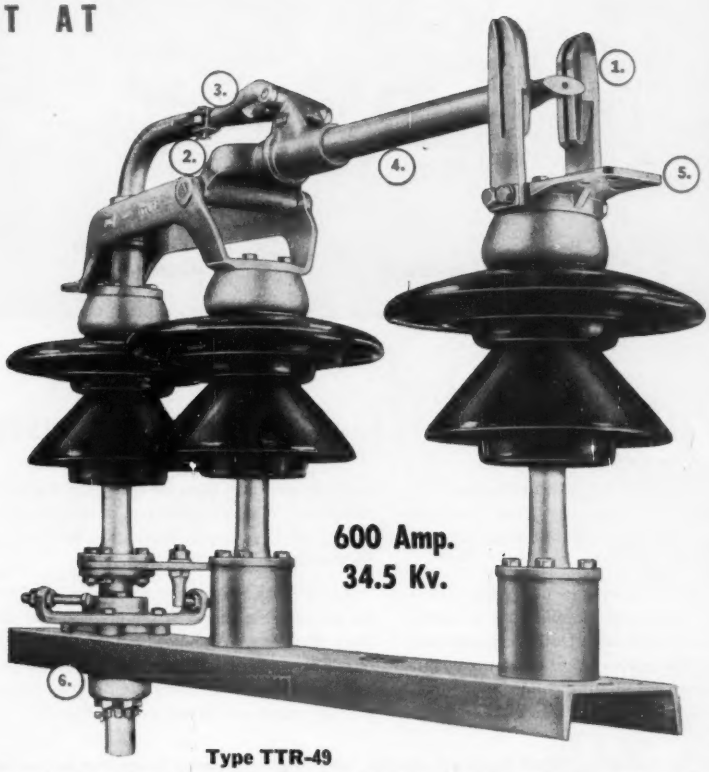
Check the Facts on

The NEW Type TTR-49 Disconnecting Switch with Sealed Pressure Hinge Contact

NO EXPOSED CONTACT AT HINGE



Type TTR-49

1 JAW CONTACT—Hi-Pressure, Hi-Thermal capacity silver to copper contact. ONLY ONE BREAK CONTACT ON THE SWITCH. Copper and beryllium jaw—copper for thermal capacity and beryllium for strength and resilience. Here's maximum protection against fault current damage.

2 HINGE CONTACT—Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, annular, constant electrical and mechanical contact at all times. Eliminates second break contact with its multiplied problems and maintenance.

3 BLADE OPERATING MECHANISM — Simplified and "streamlined" to attain a simple harmonic, accurately controlled blade motion. Special pin fastenings, snap rings, and rivets have been eliminated from moving parts. Universal blade balance on 69 Kv. and above.

4 BLADE—Extra heavy, hard drawn tubular copper with integral, formed contact end. Solid current path from jaw to hinge contact.

5 TERMINALS—Four half-inch bolts on 1¾ x 1¾ inch centers permit NEMA standard 600 or 1200 Ampere clamping and R & IE Type "UC" universal clamps. Both terminals equal height from base.

6 BEARING—Aluminum housed, weather sealed, stainless ball—requires no lubrication.

39 Years of Switch Progress

Built for Outstanding Performance for the Years to come

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
AN I-T-E SUBSIDIARY

Fountain of youth... FOR ELECTRICAL INSULATION

From these glass marbles comes Fiberglas*, the unique fiber that helps make better electrical insulation . . . helps keep your equipment going longer!

Today, more than ever before, your electrical equipment must do double duty to maintain increased production. Unlike organic-base insulations, Fiberglas insulating materials withstand severe operating conditions longer, without breakdown . . . help you guard against costly down-time. Because Fiberglas is glass in fiber form, it won't burn, rot, or absorb moisture. And it resists the deteriorating effects of high heat, oils, and most acids.

Along with the entire electrical industry, we are faced with increasing civilian and military demands. We're producing to the limits of our present capacity in order to supply you, and are steadily increasing our facilities so that we may serve you better in the future.

OWENS-CORNING FIBERGLAS CORPORATION, ELECTRICAL SALES DIVISION, Dept. 858, 16 East 56th Street, New York 22, N. Y.

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FIBERGLAS IS IN YOUR LIFE . . . FOR GOOD!

*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

COPE'S NEW CABLE TROUGH IS A REAL MONEY SAVER!

COPE Cable Trough has received only praise wherever it has been installed in utility and industrial plants. Not one word of complaint has been heard. Certainly, the hundreds of outstanding executives and design and electrical engineers who chose the COPE Trough System "can't be wrong"!

For a long time, they had been hoping for a simplified, versatile and time-saving system, and COPE gave it to them. Now they realize the advantages of the rounded, streamlined fittings and appreciate the ease of installation—with the turns, branches, reductions and vertical, as well as horizontal runs—that COPE Troughs provide. Perhaps of even greater significance is the fact that they save money—yes, real money—in *both* design and installation costs.

COPE Cable Trough will also be found in the forefront for doing its part during our Country's State of Emergency, because it not only *saves man hours but also materials!* If you are not already familiar with COPE Cable Trough, write us today for Bulletin 63-A.

T. J. COPE, INC., 711 SOUTH 50th ST.
PHILADELPHIA 43, PA.

TRIED

AND

PROVED

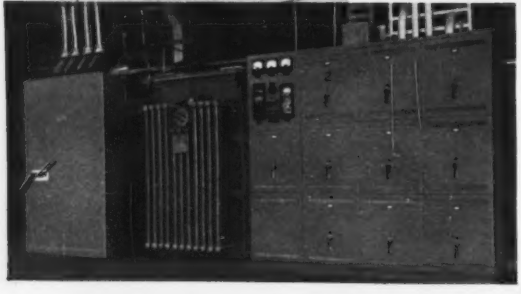
You Know Cope By These Products

T. J. Cope INC.

Wagner®
TRANSFORMERS
...the choice of leaders in industry

Wagner Unit
...designed for

switchgear
to fit
your needs



750 kva, type HPBN, 13,800 to 480 volt, 60 cycle, 3 phase Noflamol transformer in one of 14 Wagner-equipped unit substations in a large synthetic textile plant.

Wagner Unit Substation Transformers are in use in all kinds of industrial plants including: synthetic rubber, petroleum, steel, chemical, aircraft, automotive, paper, and many others. Bulletins TU-13 and TU-56 give full information. Write for your copies.

Wagner
Electric Corporation
1891 WE 1951

Substation Transformers

plant power distribution systems

The ever-increasing demand for electric energy to power today's stepped-up production presents a critical problem. The answer to this problem has been found in load-center power distribution systems. Unit substations, located near the load, provide a flexible source of power at utilization voltages which is delivered to the point of use by short secondary feeders.

The vital part of the load-center system is the transformer. If a switch or circuit breaker fails, only a part of the system is affected—but if the transformer fails, the entire system is dead.

Wagner Unit Substation Transformers assure a continuous, dependable flow of power. They are carefully designed to meet your distribution requirements. Oil-filled and non-inflammable liquid filled (Noflamol) transformers are available with various types of entrances and controls for the high-voltage circuits, and with proper throats on the secondary side to connect to any make of switchgear, in the usual range of ratings up to 2000 kva.

The importance of the transformers in your plant power distribution system cannot be over-emphasized. Consult a Wagner-trained field engineer to help you solve your load-center problems. No obligation, of course.

Dry Type Indoor Transformers

in ratings from 100 to 2000 kva

To meet industry's growing need for larger indoor dry-type load center transformers, Wagner now furnishes three-phase dry-type transformers in ratings up to 2000-kva in the 15-kv class and below. Especially developed for plant power distribution circuits, these units are compactly housed in neat, attractive enclosures, which can be arranged to include primary and secondary switchgear compartments to form readily accessible, closely-coupled unit substations. Complete enclosure of all equipment protects against accidental contact with live parts. Relatively light in weight, so that they can be used in multi-story buildings, they are readily adaptable to any installation requirement.

WAGNER ELECTRIC CORPORATION

6456 PLYMOUTH AVE. • ST. LOUIS 14, MO., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES

AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

T51-6

FOR CIRCUIT SECURITY IN POWER PLANTS FOR YEARS AND YEARS TO COME...

Okolite-Okoprene generator lead: Semicon tape protection over segmental conductor, heavy wall of Okolite insulation, metal shielding tape and non-flammable, non-metallic Okoprene sheath.

1

Switchboard and lighting wire at its simplest: Okoloy-coated conductor and Okolite-Okoprene covering (in colors).

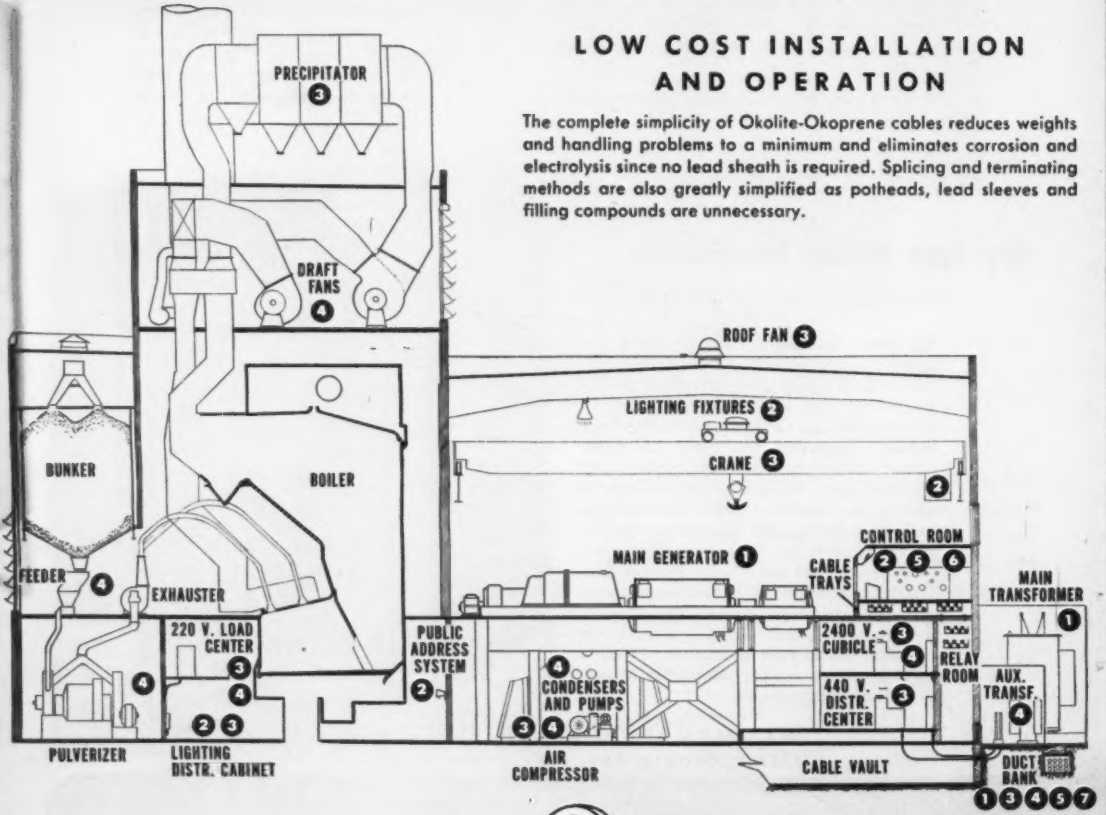
2

For lower voltage power circuits: single conductor Okolite-Okoprene wire and cable in all standard sizes.

3

LOW COST INSTALLATION AND OPERATION

The complete simplicity of Okolite-Okoprene cables reduces weights and handling problems to a minimum and eliminates corrosion and electrolysis since no lead sheath is required. Splicing and terminating methods are also greatly simplified as potheads, lead sleeves and filling compounds are unnecessary.



OKONITE
PASSAIC, N.J.

OKONITE

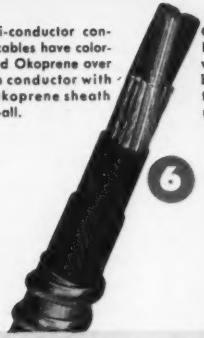
OKOLITE-OKOPRENE STATION CABLES
ARE THE TIME-PROVED ANSWER

4

In all Okolite-Okoprene power cables for use over 2kv Semi-con-Taped conductor prevents internal corona-cutting.

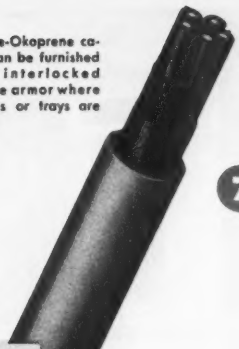
5

Multi-conductor control cables have color-coded Okoprene over each conductor with an Okoprene sheath over-all.



6

Okolite-Okoprene cables can be furnished with interlocked bronze armor where troughs or trays are used.



7

For wet underground runs, lead-sheathed Okolite-Okoprene cables provide extra security (note rubber fillers).

FOR THESE LOCATIONS AND NEEDS...	...OKOLITE-OKOPRENE STATION CABLES PROVIDE THESE PROPERTIES
LONG LIFE AND RELIABILITY All electrical circuits.	Confirming nearly a quarter-century of field experience, continuous aging tests of Okolite insulation checked at intervals in Okonite's proving ground, show practically no change in physical and electrical characteristics. Okolite oil-base insulation, applied by Okonite's strip process, is made with wild Up-river Fine Para rubber established over many years of steady use as stable and dependable. Exposure tests and service records over 13 years have proved the durability of Okoprene coverings.
ELECTRICAL STABILITY All control, power, lighting, switchboard, and communication circuits.	Electrical measurements made on Okolite insulation after 8 years immersion in water show the insulation resistance unchanged from the excellent values recorded in the first 6 months. Insulations made with synthetic rubbers show no such stability. Retention of Okolite's stable electrical qualities is further insured by the Okoprene sheath that seals the insulation from terminal to terminal.
HIGH DIELECTRIC STRENGTH AND OZONE RESISTANCE Generator and transformer leads, auxiliary power circuits, test cables, etc.	Okolite's high dielectric strength is greatly increased by the use of Semicon tape over conductors operating above 2000 volts. Therefore, in addition to a-c. tests at voltages 25% greater than IPCEA requirements, all such Okolite-Okoprene cables are also given a self-imposed d-c. kenetron test at 3 to 4 times the IPCEA 60-cycle a-c. values. Internal and external ozone attack is resisted in 4 ways: (1) Okolite insulation is ozone-resistant, (2) Semicon tape prevents internal corona discharge, (3) Okoprene covering is not only ozone-resistant but (4) does not develop static discharge below 5000 volts.
MOISTURE RESISTANCE Cables in ducts, troughs, or buried direct and wherever condensation exists.	Okolite insulation—*without any lead covering*—has been used for 20 years in submarine power cables, some of which operate at 35,000 volts. From its Okoprene sheath that cannot rot to its conductor coated with Okoloy—the lead alloy that outlasts tinning 2 to 1—an Okolite-Okoprene cable resists attack by moisture.
HEAT RESISTANCE Boiler rooms, tunnels, and other hot locations and for heavily-loaded cables.	Okolite insulation, recommended for use at 75 degrees C up to 8000 volts and 70 degrees C above 8000 volts, is suitable for heavy current loadings or for hot locations. Since equally heat-resistant Okoprene coverings will not support combustion, Okolite-Okoprene cables are also non-flammable, a feature of prime importance in station design.

8054

Neither engineers nor officials can afford to use the key unit in their system—the power plant—as an experimental laboratory. For that reason central station after central station is being wired throughout with Okolite-Okoprene station cables which have time-proved records for reliability and long life. Their vital electrical insulation is oil-base Okolite, made with natural wild rubber, and known for over 20 years for its high dielectric strength, moisture-resistance and stability.

Okolite-Okoprene station wires and cables are available in a complete range of designs from switchboard wire and control cables to heavy, shielded generator leads of the largest dimensions. For circuit identification individual conductors can be supplied with colored Okoprene coverings. Many utilities prefer to use single conductor cables, on reels individually, or wound three cables in parallel, or twisted together without other coverings. Others are obtaining multi-conductor assemblies with an over-all Okoprene jacket.

Okolite-Okoprene cables may be installed in conduit, on trays or racks, buried direct or exposed to the weather. For complete information, including installation records, current carrying capacities, dimensional data and splicing instructions, ask for the data file described on the next page.

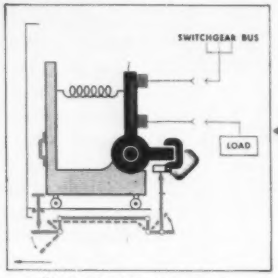
OKONITE SINCE 1878 ***insulated wires and cables***

I-T-E SWITCHGEAR GIVES YOU *DOUBLE PROTECTION*

Have you ever considered the results of a sudden loss of power in your plant—lights going out, machines stopping, possible injury to personnel? It could be a trying and costly experience, particularly if it could easily have been prevented!

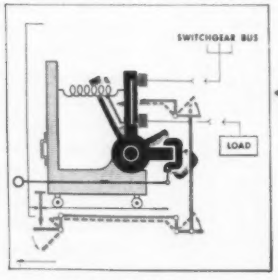
The purpose of your switchboard is to minimize power shutdowns and protect equipment and personnel. I-T-E switchboards do these things and much more. They offer you *double protection*—because mechanical interlocks of a design unique with I-T-E protect the drawout circuit breakers which in turn protect your power distribution system.

A mechanical interlock prevents the circuit breaker from being connected to or disconnected from line and load connections *unless the breaker's contacts are open.* If this is not accomplished, withdrawal of the circuit breaker would cause arcing at the disconnect device, probable subsequent damage to the equipment, power loss and injury to personnel.



The interlock by "deduction"

The ordinary interlock works by "deduction"; that is, movement of the interlock's mechanical linkages disengages the latch which holds the breaker in a closed position. The breaker's contacts *should* then be open, but the breaker may then be moved in or out whether or not the contacts are actually open.



The interlock by I-T-E

On the other hand, I-T-E's interlock is safe, sure, simple. This interlock mechanism is connected directly to the arm which carries the movable contacts. Unless the breaker has been fully opened by a separate manual tripping action, it *cannot* be moved into or out of line and load engagement.

The I-T-E interlock is a simple but important feature. Your operator's life and your plant's safety may depend on it. It's just one more reason why *I-T-E is your best switchgear buy!*

For more information about I-T-E Multumite Switchgear, send for bulletins 6003-D and 7000-A.

For *more dependable* Switchgear

specify I-T-E!

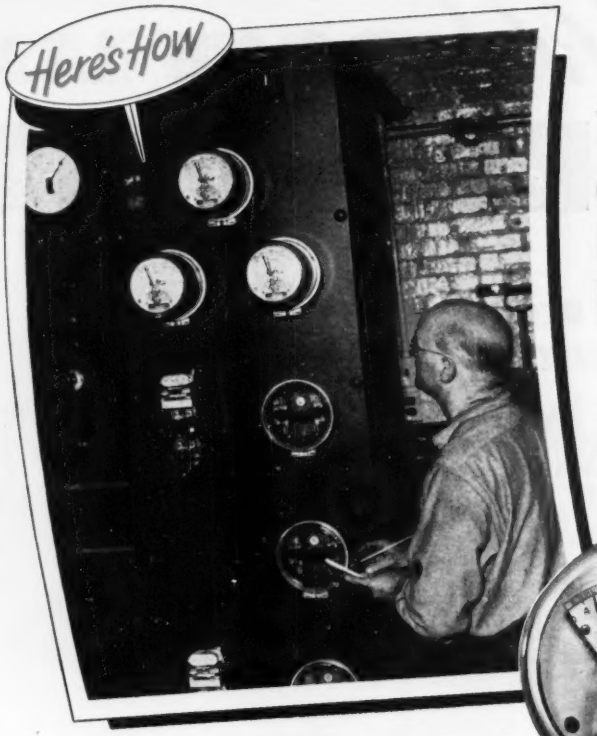
I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

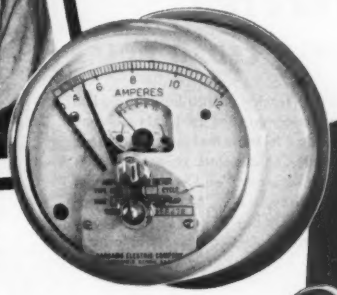
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

Here's How

You can get more out of your present Distribution Equipment...



Lincoln Type ADS Ampere Demand Meters, mounted on a switchboard at Duquesne Light Company, Pittsburgh, Pa.



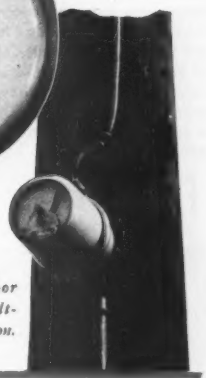
LINCOLN Ampere Demand Meters and Indicating Voltmeters

Maximum return from existing distribution equipment results from systematically applied voltage control, and loads balanced between feeders. Simple changes in the system that add up to greater kilowatthour consumption can be effectively made on the basis of continuous voltage information all along your system.

Lincoln Ampere Demand Meters measure the continuous facts needed to help balance the load between phases on feeder lines for most effective use of system and distribution capacity. They show the demand on the feeder phase at all times as well as the maximum demand reached since the last manual resetting.

Lincoln MiniMax Indicating Voltmeters permit low-cost, permanent installations that provide continuous information for setting voltage regulators and for solving other voltage control problems while saving the heavy labor costs of periodic surveys.

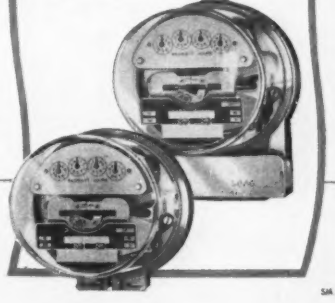
For most effective results—at the lowest cost—put this winning combination to work on your system. Write for full information today.



Typical outdoor MiniMax Voltmeter installation.

Sangamo J Meters

These watthour meters meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance, and troublefree performance.



Only Measured Facts are Known Facts

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

The Best POLE LINE CONSOLIDATED

YOUR CONSTRUCTION REQUIREMENTS PROMPTLY FILLED WITH

LIFE-SPAN

Treated

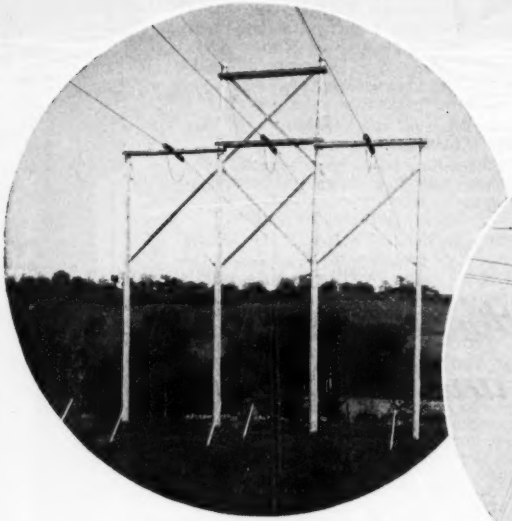
WESTERN RED CEDAR POLES

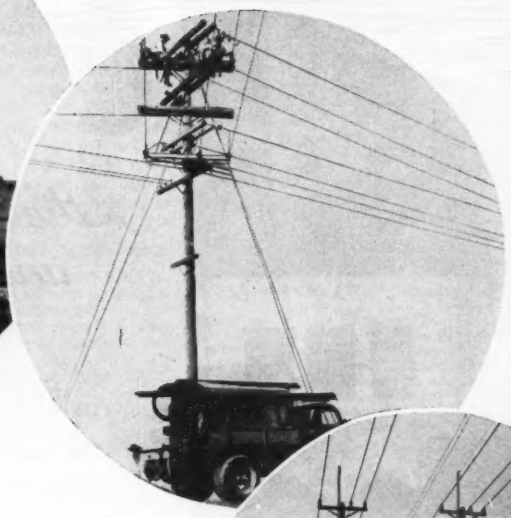
If your plans call for high tension or distribution pole line construction soon or for construction to begin at some future date, you'll be glad to know that your pole needs will be ready for you at Consolidated. Large quantities of Nature's No. 1 poles, Western Red Cedar, are being treated the LIFE-SPAN way, daily. Whether your approaching construction job is big or one requiring only a carload of poles, Consolidated can give you prompt delivery.

Actual photo of New Western Red Cedar Stocks in CONSOLIDATED Yards. Photo taken January 3, 1950.

CONSTRUCTION begins at TREATING CO.

MINNEAPOLIS MINNESOTA





Built by NATURE...

Perfected by LIFE-SPAN

Man has searched but has never found a finer specimen for power poles than Western Red Cedar. Man has tried but has never developed a better pole preservative process than LIFE-SPAN. Together they offer an unbeatable combination.

Straight, strong, lightweight Western Red Cedar poles treated the LIFE-SPAN way assure you of dependable service up to pole line obsolescence. Linemen prefer LIFE-SPAN poles because they are safe to work on, easy and clean to handle and to climb. Utility companies like them because they offer long, dependable service unmatched by any other pole. LIFE-SPAN Poles are bound to build good public relations for the companies who use them.

TO BE SURE, TO BE DOUBLY SAFE... SPECIFY LIFE-SPAN WESTERN RED CEDAR POLES.

The same LIFE-SPAN treatment is also available for Fir, Western Larch and Lodgepole Pine.

Sold only by the following:

PAGE & HILL, INC.
Minneapolis, Minnesota
50 Church Street, New York, N.Y.

B. J. CARNEY & CO.
Spokane—Minneapolis

SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho
Suppliers for Joslyn Mfg. & Supply Co.

NAUGLE POLE & TIE CORP.
Chicago, Illinois

· *the* falling Apple ·· *and* falling Water

THE LAW OF GRAVITY in operation!

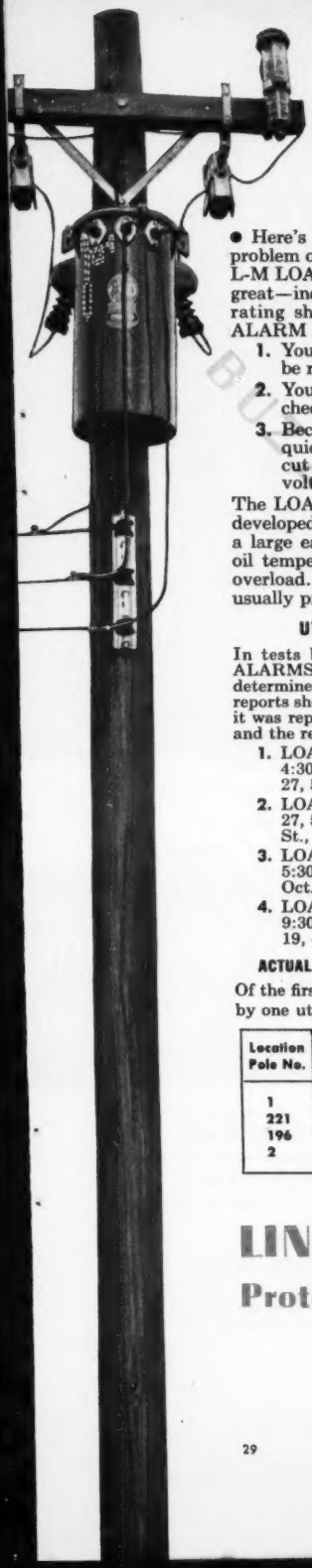
S. Morgan Smith was one of the first in this country to successfully apply this principle!

The almost 75 years, that have passed since his start, mark great achievement in the building of Smith hydraulic equipment - and turbines, alone, totalling more than 12 million Hp. capacity! This reservoir of designing, engineering, research and field experience is yours, when you place your hydraulic problems in our hands! Drop us a line - today!

S·MORGAN SMITH COMPANY
YORK·PENNSYLVANIA~U·S·A·

If It's Hydraulics-Put It Up to Us·

POWER *by* SMITH



Cut Transformer Burnouts... Cut Load-Check Costs...with NEW L-M TRANSFORMER LOAD-ALARM*

● Here's the simple, economical answer to the problem of locating overloaded transformers. The L-M LOAD-ALARM signals when the load is too great—indicating that a transformer of higher kva rating should be installed. Using the LOAD-ALARM means:

1. You save transformers because they can be replaced before they burn out.
2. You eliminate the need for costly load checks to locate overloaded transformers.
3. Because overloaded transformers can be quickly located and then replaced, you cut down the number of customer low voltage complaints.

The LOAD-ALARM is a simple, thermal device developed by L-M engineers in cooperation with a large eastern utility company. It operates on oil temperature rise caused by prolonged heavy overload. It emits an audible signal which is usually promptly reported by the customers.

UTILITY MAKES TIME-CLOCK TESTS

In tests by a large eastern utility, L-M LOAD-ALARMS were set by time clock to operate at predetermined times of the day. Following are a few reports showing time the alarm began operating, time it was reported, and location of the test transformer and the reporter's residence.

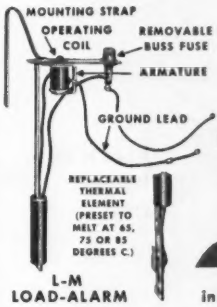
1. LOAD-ALARM at 371 Villa St., Sept. 27, 4:30 P.M. Reported from 361 Villa St., Sept. 27, 5:20 P.M.
2. LOAD-ALARM at 133 Knowlton St., Sept. 27, 5:00 P.M. Reported from 129 Knowlton St., Sept. 27, 5:08 P.M.
3. LOAD-ALARM at 61 Grosvenor, Oct. 7, 5:30 P.M. Reported from 40 Belmont St., Oct. 8, 10:00 A.M.
4. LOAD-ALARM at 105 Hickory, Oct. 17, 9:30 A.M. Reported from 111 Hickory, Oct. 19, 4:00 A.M.

ACTUAL OVERLOADS REVEALED BY LOAD-ALARMS

Of the first 15 LOAD-ALARMS put in actual service by one utility, four operated under these conditions:

Location Pole No.	ALARM Reported by	Transformer Rating	Actual Load
1	Customer	15 Kva	28 Kva
221	Employee	15 Kva	27 Kva
196	Several customers	15 Kva	29 Kva
2	Several customers	50 Kva	85 Kva

"Use of this device allows us to make greater use of our transformer capacity," says one of this utility's district superintendents. "It allows us time to make secondary surveys before changing transformers. Necessary replacements can be made during normal working hours instead of on overtime, and long interruptions and burnouts and resulting rewinding costs are eliminated."



L-M LOAD-ALARM

L-M LOAD-ALARM in position in transformer tank.

Continuous overload causes the oil temperature to rise. When oil temperature reaches the predetermined melting point of the alloy thermal element, the alloy melts, setting off the buzzer. Transformer acts as sounding board; secondary conductors carry the sound to connected structures. When customers phone (and they do!) lineman removes the fuse through the handhole, silencing the buzzer until it is convenient to make a load check and install a transformer of higher rating.

TRY IT YOURSELF!

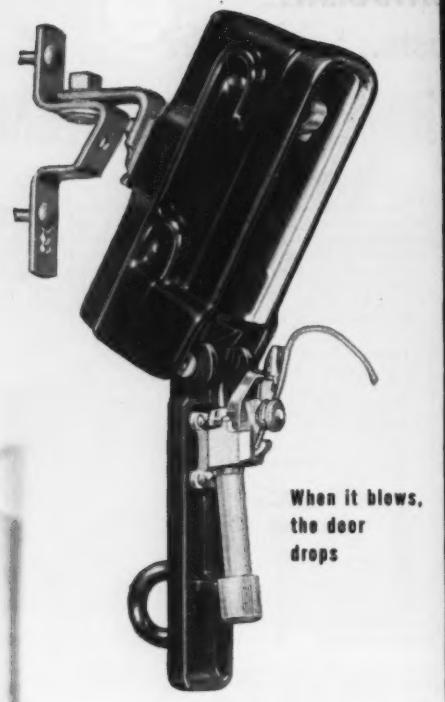
L-M LOAD-ALARMS cost about $3.00. Order enough for a test, right now. Order from the L-M Field Engineer or direct from Line Material Co., Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

*Trademark

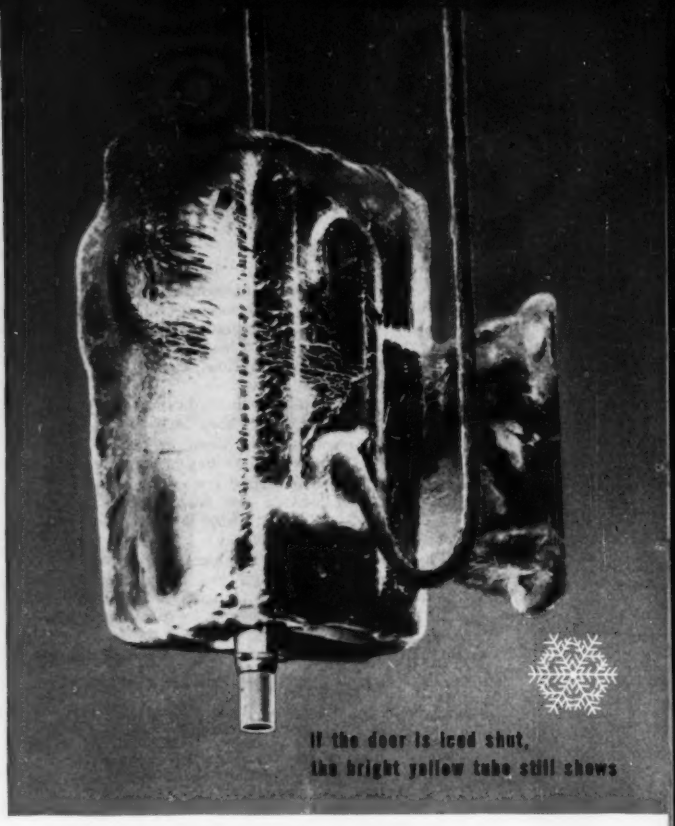
LINE MATERIAL

Protective Equipment

LM



When it blows, the door drops



If the door is iced shut, the bright yellow tube still shows

You get *Dual Indication*

with L-M's PVD® 561 the all-weather cutout

In summer or winter, sunshine or sleet, you can count on the DUAL INDICATION of the PVD 561. When the fuse blows, the flip-out device rapidly withdraws and ejects the blown link. Upper contact spring pushes the tube down, releasing the door, which is then forced out by pressure of the lower contact spring. Works like a charm!

If the door should be iced shut, the tube still drops. Its bright yellow plastic is a vivid indication to the lineman that he'd better do something about it.

Operation assures positive disconnect—there are no live parts on the door, which is easily unhooked for re-fusing. High-grade wet-process porcelain housing. Heavy copper contacts with silver-plated surfaces. Positive contacts and substantial current-carrying parts assure low operating temperatures. Non-ferrous parts eliminate danger of corrosion. Instant, smooth operation.

Two ratings: PVD-561, 5000 V, 50 amps; PVD-761, 7500 V, 50 amps. Both have rated interrupting capacities of 1200 amps. Door and cartridge assemblies interchangeable with the PVD-56 and 76. By carrying a spare fused door the lineman can re-fuse either type in 60 seconds or less.

Easy Way to Get Details

Ask the L-M Field Engineer for Bulletin FC2 or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL Fuse Cutouts and Fuse Links

Complete Coordinated Equipment for Distribution Today

safer!

That's why re-fusing is safer with L-M PVD Fuse Cutouts!

THE LINEMAN DOESN'T NEED TO TAKE CHANCES

when he re-fuses *Line Material* Fuse Cutouts. They're designed for safety!

The large pull ring handle plus the little hook on the flipper assembly enables him to open, unhook and remove the door completely, re-fuse and replace it (or a spare fused door, if he's in a hurry)—all with a switch stick. He doesn't get his hands anywhere near hot leads or contacts.

See how easily it's done. Get a sample and try it yourself! Then compare the many other operating and safety features of L-M Fuse Cutouts. You'll see why so many utility companies have standardized on L-M Cutouts. Ask the L-M Field Engineer for details on the full L-M line of open and closed cutouts; or write Line Material Company, Protective Equipment Division, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LM®

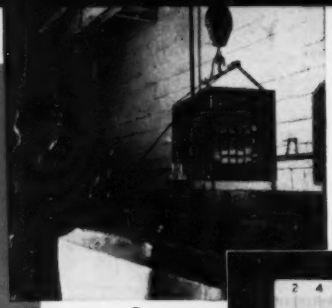
PVD is a registered trademark of Line Material Company. (A McGraw Electric Company Division)

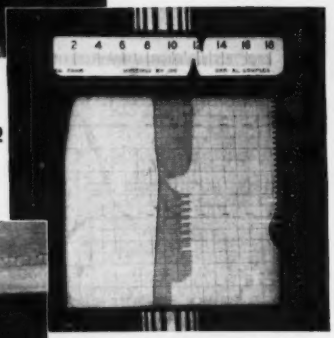
31

LINE MATERIAL Fuse Cutouts and Fuse Links

Complete Coordinated Equipment for Distribution Today

how L-M STOPS RUST of line construction materials



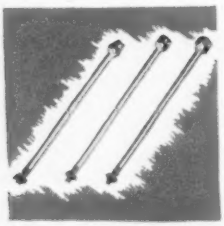


Illustrations show some of the important factors in L-M hot dip galvanizing. (1) improved methods of degreasing, pickling, and washing to assure clean surface and perfect adhesion . . . (2) precise temperature controls to assure even coatings . . . (3) centrifuging removes excess zinc to assure clean threads.

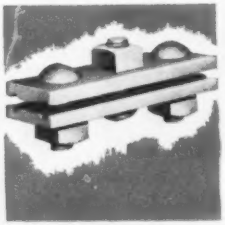
● Good galvanizing, under controlled conditions, is the secret of the quality of L-M construction materials.

Pinholes in galvanizing invite rust. Uneven coatings wear through in spots. A coating that's too thick, or rough, makes nuts turn hard, slows down the lineman. So L-M takes all possible precautions to assure smooth, even coatings, that stop rust as long as possible.

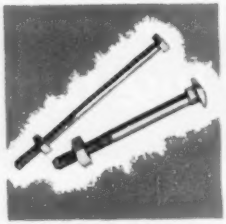
For information about L-M equipment, ask the L-M Field Engineer, or call the nearest of 77 L-M sales offices and warehouses throughout the country, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



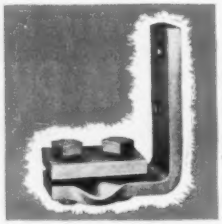
Strand Eye Anchor Rods, in single, double, and triple eye styles, do away with the elusive thimbles. Rod eyes conform to curvature of guy strand, permit the strand to be pulled tight without distortion.



L-M Guy Clamp, with high-strength bolts and Torkol-treated nuts for easy tightening, firm holding, with no thread-corrosion. Heavy steel, hot-dip galvanized. Square holes keep bolt from turning.



Machine and Carriage Bolts have clean-cut threads, true heads, ample tensile strength. L-M bolts 6" and longer have buffer points for easy driving —in, and for driving out without battering threads.



Universal Messenger Hanger for minimum clearance between pole and conductor. Flared groove prevents nicking the strand and permits use of this hanger on both small angle and straight runs.

24-R

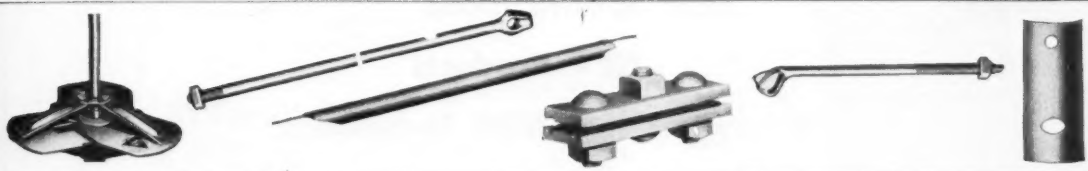
LINE MATERIAL . . .
Line Construction Materials

The Most Important Guy in Line Construction

● L-M makes a wide variety of line construction materials. But none are more important than L-M guying equipment, for if the guy goes, the line goes.

So L-M guy hooks, attachments, clamps, and rods are made of high quality materials, heavily hot-dip galvanized under precisely controlled conditions.

L-M, one of the great names in electrical equipment research, is also one of the great names in line construction materials. L-M materials are recognized for their strength and dependable high quality. They are available for prompt shipment through 77 L-M sales offices and warehouses throughout the country.



3-Way Expanding Steel Guy Anchor | Steel Single Strand Eye Anchor Rod | Steel Guy Wire Protector | Guy Clamp with Torkel-treated Nuts | Angle Single Strand Eye Bolt | Galvanized Steel Lift Plate

● Line Material offers a wide variety of line construction hardware and specialty items to solve almost any construction problem. Ask the L-M Field Engineer for details and bulletins. Or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

25-R

LM

LINE MATERIAL...

Line Construction Materials

Can You Handle

A *BIGGER* PRODUCTION MIRACLE — just as your plants get back to normal from the previous miracle of production?

In the shift to all-out production you now face —

NEW Specifications

NEW Products

NEW Techniques

All Require Broad Laboratory Checks

GOVERNMENT DEPARTMENTS require more rigid qualification tests than ever, but ETL is now a recommended qualifying agency.

ETL is again at the call of producers in guarding against penalties arising from

NEW SPEEDS
NEW MATERIALS
NEW WORKERS

ETL services to production are condensed in this booklet. Copy on request.

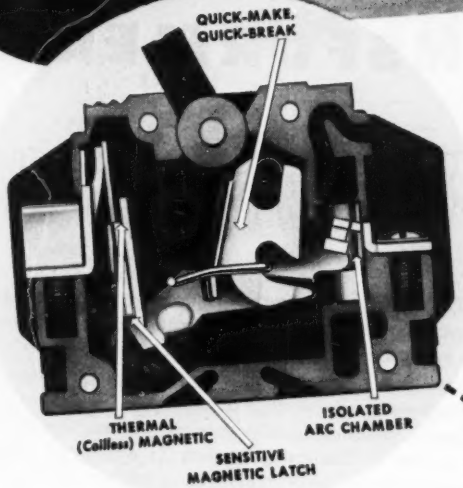
ETL's PATTERN
in the last miracle—
Services and tests provided for the harassed production men included:

Abrasives • Acoustic Materials • Adhesives • Airplane Accessories and Parts • Anti-Static Materials • Armor Plate • Automotive Accessories • Binoculars • Batteries • Building Materials • Buttons for Uniforms • Chemicals • Chemical Analyses • Cloth • Conductivity Cells • Condensers • Containers, Metal • Cord • Cream, Sunburn Preventing • Earthenware • Electrical Condensers • Electrical Equipment • Electronics • Engineering Assistance • Felt • Fiberglass • Filling Compounds • Film • Flares • Flooring Material • Flue Covering • Foghorns • Food Containers • Gauges • Glass • Governors • Graphite • Hats • Hydraulic Equipment • Illumination • Ink • Insulating Material • Ceramics • Oil • Plastics • Miscellaneous Materials • Airfield Lighting Equipment • Blackout Lamps • Daylight Signal Lamps • Explosion-proof Lighting Units • Fluorescent Lighting Units • Fluorescent Lamps • Incandescent Lamps • Incandescent Lighting Units • Lighting Filters • Lenses • Lipsticks • Liquids • Load Surveys • Locator Coils • Measuring Instruments • Metals • Mirrors • Munitions • Optical Materials • Paints • Paper • Photometers • Physical Tests • Porthole Blackouts • Protective Coatings • Radios • Rectifiers • Rotary Converters • Rubber • Rubber Substitutes • Safety Equipment • Ships Lanterns • Static Electricity • Steel • Tape • Terminal Lugs • Temperature Measurements • Test Facilities • Tile • Tools, Cutting • Tonometers • Transformers • Transformer Oils • Transmission Belts • Transmission Cables • Watches • Waxes • Window Screening Materials • Wire • Wool • Wratten Filters

Know ETL *by Test*

ELECTRICAL TESTING LABORATORIES, INC.
2 EAST END AVENUE at 79th STREET
NEW YORK 21, N. Y.

NEW TYPE QB CIRCUIT BREAKER
for NQB Lighting Panelboards



a NEW QB circuit breaker for NQB panelboards features an isolated arc chamber lined with arc resisting material which eliminates need for metal plates or other interrupting means. Operating mechanism is quick-make, quick-break. Stainless steel latch, independent of trip element, assures superior vibration characteristics. Thermal-(*Coilless*) Magnetic trip element is typical of other lighting panelboard types in Square D's broad line.

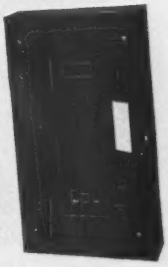
All Have 2-WAY PROTECTION

THERMAL element is a bi-metal providing positive and timed response to heating effects of both load current and surrounding atmosphere. The life of wire insulation is prolonged by limiting total temperature to a safe value.

MAGNETIC element responds instantaneously to the higher values of current characteristic of dangerous overloads and "shorts." Damage is minimized.

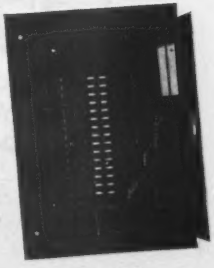
Both ARE NEEDED FOR Complete PROTECTION

Completes the Line



TYPE **NMO**
MO Plug-In
Standard Duty breakers
for AC systems

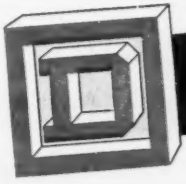
TYPE **NQB**
QB heavy duty
breakers for
AC systems



TYPE **NAB**
ML heavy duty
breakers for
AC-DC systems

Write **for Bulletin 1640, Square D Company, 6060 Rivard Street, Detroit 11, Michigan**

ASK YOUR ELECTRICAL WHOLESALER FOR SQUARE D PRODUCTS



SQUARE D COMPANY

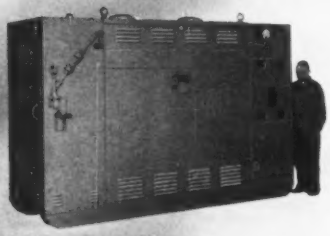
DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Standard
TRADE MARK ®

TRANSFORMERS. . .

*Dry type load center unit sub 1,000 KVA.

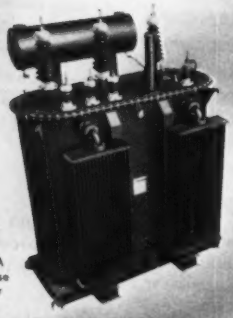


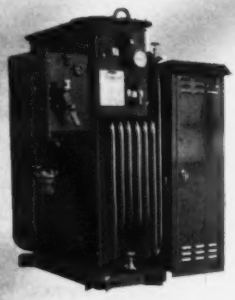
BUILT TO YOUR REQUIREMENTS TO SERVE A SPECIFIC NEED

● In addition to standardized designs and types, The Standard Transformer Company has a long established record of engineering and manufacturing transformers exactly suited for specific operations. Our one job, for more than a quarter of a century, has been to produce transformers. There has never been sacrifice of materials, methods or skills in producing Standard's quality product . . . basic construction is unsurpassed. Complete freedom to specify accessory equipment, permits closer adherence to job requirements.

*69 KV OISC metering set.

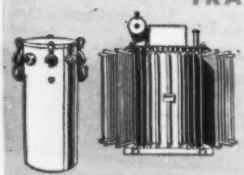
*3,000 KVA OISC 3-phase 69 KV power transformer.



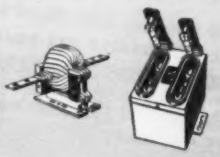


*Askarel load center unit sub 300 KVA.

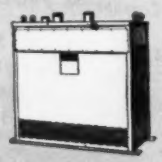
TRANSFORMERS FOR EVERY APPLICATION



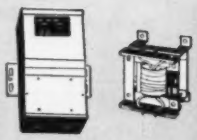
Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)



Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

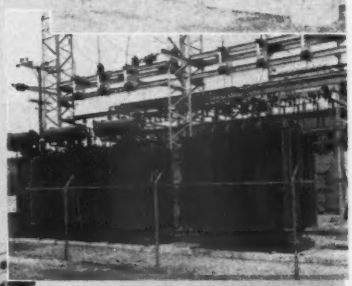
Standard
TRADE MARK ®

. . . . . ON THE JOB

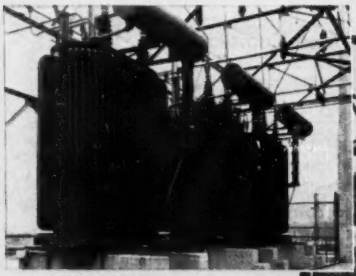
PROVES SUPERIORITY THROUGH LONG LIFE AND TROUBLE-FREE PERFORMANCE

● Hundreds of The Standard Transformer Company's transformers are installed and operating all over the world today, and considerable evidence proving long years of trouble-free service by Standard transformers flows into our offices daily. Factual testimony proving efficient performance is ample. Our engineering staff and production teams are geared to cooperate efficiently with servicing your order. For the complete story — write for our brochure "Standard transformers . . . on the job."

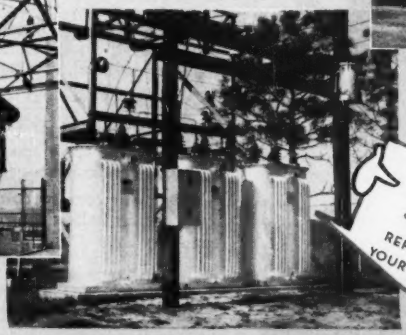
● An installation helping to power atomic research.



● Three 2,000 KVA single phase and one 5,000 KVA 3-phase transformers serving a large manufacturing plant in the Midwest.



● A 15,000 KVA substation, Mill Creek Pumping Station, Cincinnati, Ohio.



● 1,000 KVA Bank at Myrtle Beach, South Carolina.

THE Standard TRANSFORMER CO.
TRADE MARK ®

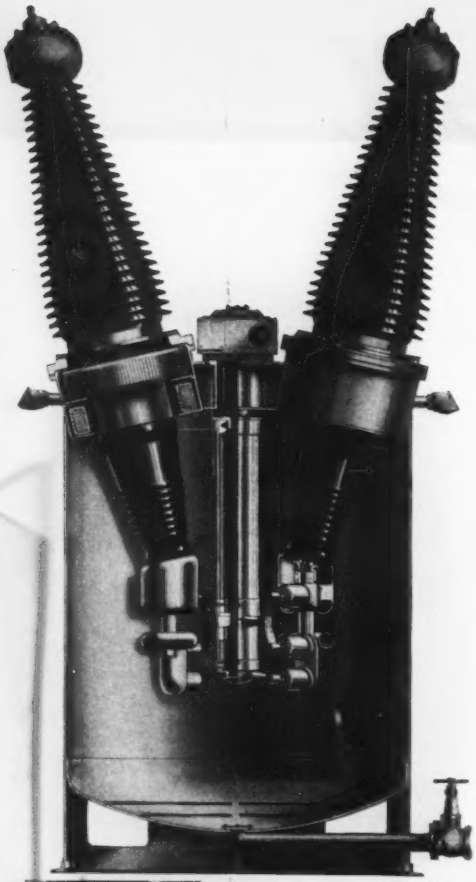
WARREN . . . OHIO

(REPRESENTATIVES IN PRINCIPAL CITIES)

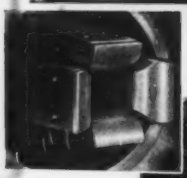
. . . . for Improved High-Voltage Switching

PACIFIC ELECTRIC TYPE RHE OIL CIRCUIT BREAKERS for

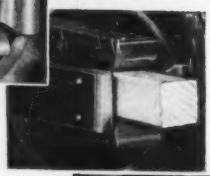
REDUCED MAINTENANCE
IMPROVED RELIABILITY



Above:
Sectional Elevation
196/230-kv Rating.



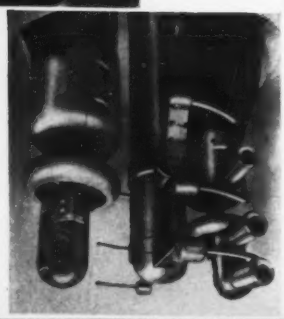
At left:
OPEN.



At right:
CLOSED.

Above:
Sliding-Shoe Nested Contacts (with Interrupters Removed).

At right:
Interrupters and Blades (one side only).



Verify the worth of each of these listed features in the light of your own experience

Only One Moving Element in the Tank

Moving as one piece, the rotary blade-structure provides six equal-length gaps in series per pole, totaling 80 to 96 inches, according to rating.

All gaps open at equal speed throughout entire stroke, and open fully before reclosing starts.

The rotary form permits adequate blade acceleration without need of auxiliary levers or multiplying linkage in the contact housings for increasing initial speed.

Nested Sliding-Shoe Contacts

No sensitive adjustments required to fix closed position.

Arcing does not affect surface carrying load current.

Wiping action smooths and cleans surfaces.

Leaf springs apply adequate pressure regardless of wear of the shoes; eliminates need of pressure adjustment.

As moving contacts do not charge auxiliary springs nor drive contact linkage, impact on bushings and battering of stationary contact shoes is negligible.

Improved Interrupters

Oil blast interrupters confine thermal effects within the interrupting chambers. Oil is not directed into or alongside of arc path; however, relatively cool oil vapor rapidly replaces ionized portions. The usual large gas bubble does not form, with the result that ground shock and jar caused by oil displacement within the tank is eliminated.

Oil-gas separators are thereby rendered unnecessary, so are not used.

PACIFIC ELECTRIC
5815 THIRD ST., SAN FRANCISCO 24, CALIF.

PACIFIC "RHE" Oil Circuit Breakers

Many of America's leading power systems have installed these circuit breakers, or have them on order.

3-Cycle Interrupting; 10-Cycle Closing;
15- to 45-Cycle Adjustable Reclosing
115, 138, 161, 196/230, and 230 Kv
Continuous Rating, 800 and 1200 Amp
Interrupting Rating to 10,000,000 Kva at 230 Kv

Compressed-Spring Closing

The compressed operating springs stand ready for action —for years, if necessary—without anything meanwhile having to move or operate.

Operating-spring compression is by motor-operated oil-hydraulic jack which is under pressure only for the ten seconds necessary to compress the closing springs.

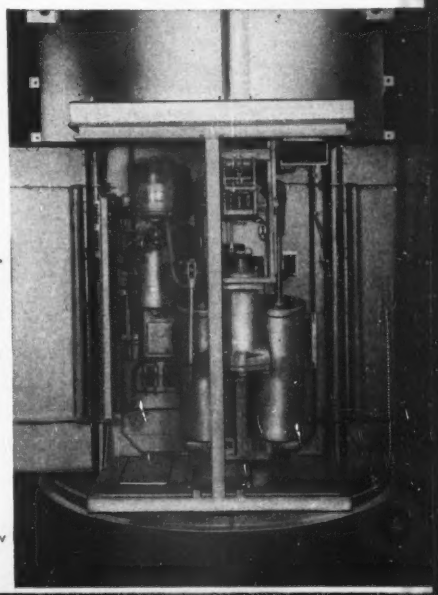
Design interrupting tests up to 9,620,000 kva were conducted on prototype circuit breakers at the Grand Coulee Switchyard in June, 1948.

Motor-Operated Main Mechanism

The opening and closing latches, the closing-energy system, oil-hydraulic decelerators, control circuits, and auxiliary switches are housed in dust-proof cabinet mounted on No. 1 pole. All operating forces are self-contained within compression tubes that surround pull rod and connect main and tank-top mechanism housings.

The velocity of any mechanism part (aside from the opening latch) does not exceed 8 ft. per sec. (the speed of a body falling one foot). Impact is thereby eliminated as a problem.

The mechanism is electrically and mechanically trip-free.



Main Operating Mechanism with doors open. Shows the two cylindrical housings that contain the closing springs, as well as motor, closing latch, and jack cylinder.

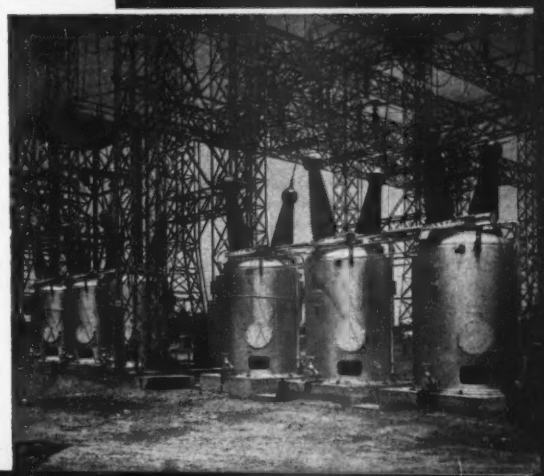
Opening Forces Externally at Tank Tops

Each pole has individual external kick-off springs that apply opening force directly to the crank arm of the rotating unit. For ease of inspection, all opening toggle linkage is also outside of the tank. A follow spring at end of pull rod on No. 3 pole completes the opening stroke that was started by the tank-top kick-off springs.

Emergency Manual Operation

Should control power fail, manual latch tripping provides a close-open or open-close-open sequence as necessary. If power remains off, two minutes operation of hand oil pump restores full operating energy.

Below: Two 196/230-kv Type RHE's on the line.



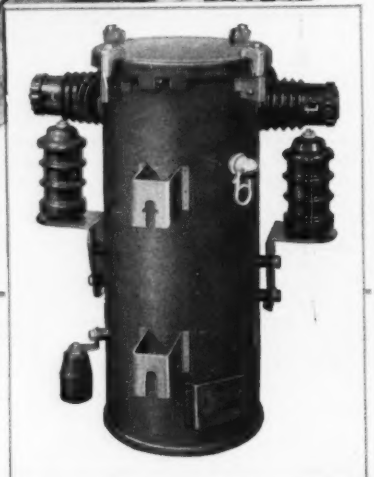
Advanced Design

Integral assemblies and multiple functioning of parts greatly simplify and reduce number of parts and adjustment points. Mechanical linkage interlocking eliminates need for an anti-pumping relay, and it permits reduction of the number of position-check switches to only one.

MFG. CORPORATION
P. O. BOX 419, GARY, INDIANA

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



A new line of "CSP" Transformers, with wall-mounted, high-voltage bushings and "De-ion®" arresters. Easier to install, with improved pole clearance. New, extra-strength bushings have large unbreakable "Enrup®" knobs for fast, positive hand-tightening of leads. Convenient location of arresters and brackets facilitates adaptation to wye or delta systems.

*T.M Reg. U. S. Rubber Co.

Eliminates 80%

of your service calls

Here's how a large midwest utility credits "CSP" (Completely Self-Protecting) Transformers with greater savings . . . better personnel relations, too, because they alleviated a costly problem:

> "No one liked the necessity of calling out a full crew in the middle of the night to restore service on a conventional transformer because of a simple fuse outage. *'Midnight Nuisance'* is the term we applied. Our linemen used even stronger language.
>
> "Now, 'CSP' Transformers give ample warning of overload conditions. The Emergency Control provides reserve capacity to forestall outages until change-outs are convenient. Since we've standardized on 'CSP' Transformers, we've practically eliminated the *'Midnight Nuisance'*.
>
> "Our line crews prefer their greater freedom from emergency calls . . . and our comptroller appreciates the savings!"

One sure fact stands out: "CSP" Transformers cut service costs

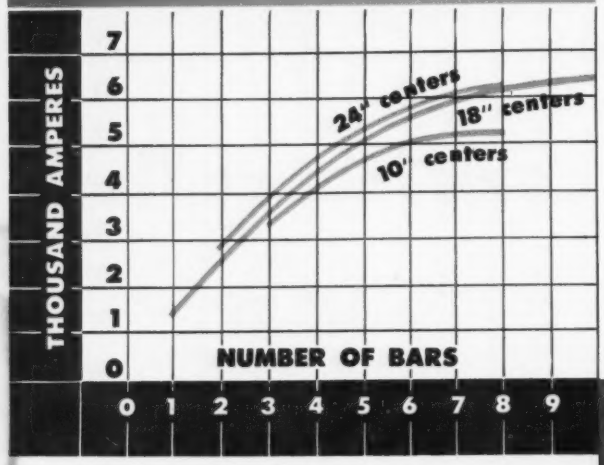
Get the full story on how Westinghouse "CSP" Transformers, with built-in lightning and thermal protection, can cut distribution costs for you. Ask your Westinghouse representative for a copy of booklet B-4249-A, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, 30, Penna.

J-70568

WESTINGHOUSE

Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE THREE PHASE BANKED SECONDARY



BUS CONDUCTOR DESIGN FACTORS and PROBLEMS

Laminated Bus Capacities

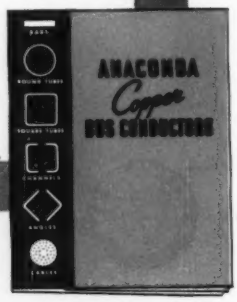
The current carrying capacity of a laminated bus construction is dependent not only on the number and size of the copper bars, but also on their location with regard to one another, to the return busses and to their surface area for dissipating emitted heat. In some cases capacity is further increased by using forced ventilation to accelerate heat dissipation.

Our Technical Department can help you plan bus equipment to meet any specified combination of load requirements and operating conditions safely and economically. Ask for the booklet, "Anaconda Bus Conductors." The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

61131

Technical Assistance in Bus Conductor Practice

ANACONDA *products and technicians are operating effectively throughout the entire field of power generation, distribution and application to provide bus conductors that will afford maximum capacity, security and economy for any specific job.*



Carry the load with ANACONDA Bus Conductors

No substitute here for EXPERIENCE

— in men and materials!

Specialized knowledge is an important part of any job. Make certain of tape quality by specifying Accurate — the tape with over 30 years experience behind its manufacture!

ACCURATE

Plastic Tape

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

Electrical men everywhere agree on—

ACCURATE TAPES

YOUR BEST BUY IN ELECTRICAL

...for every INSULATING need!

ACCURATE RUBBER TAPE

Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M.-A.A.R. grades.

ACCURATE FRICTION TAPE

High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M. grades.

...no finer tapes at any price!

For big wiring jobs or small, Accurate is the choice for positive tape protection. Both friction and rubber are strong, pliable, easy to apply. Accurate tapes make accurate wraps — pull tight and clean over irregular surfaces. When you order tape, mention Accurate by name. It's the one sure way to complete tape satisfaction. For a complete guide to tape selection and tape buying, ask for the new Accurate Data Folder. Accurate Mfg. Company, Garfield, New Jersey — address inquiries to Dept. AA.

MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION

"HOW CAN I GET THE STEEL I NEED?"

"I'D CALL U·S· STEEL SUPPLY. IF THEY HAVEN'T GOT IT, THEY'LL TRY TO HELP YOU FIND IT."

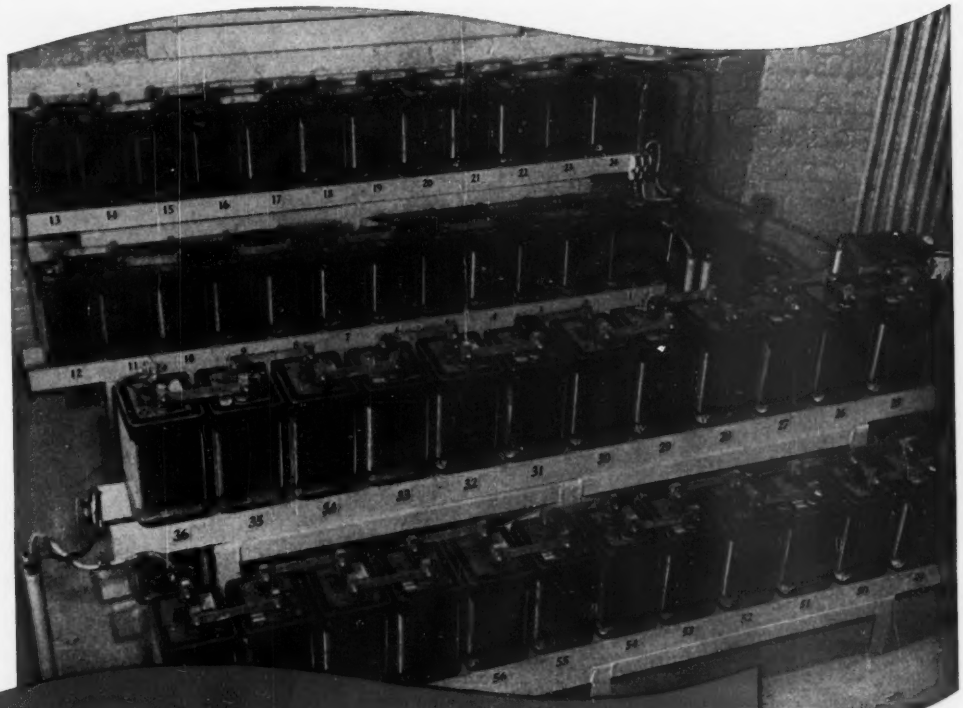
...your best source of supply...

UNITED STATES STEEL SUPPLY COMPANY

Warehouses and Sales Offices: BALTIMORE • BOSTON • CLEVELAND • CHICAGO • LOS ANGELES • MILWAUKEE • MOLINE, ILL. NEWARK • PITTSBURGH • PORTLAND, ORE • SAN FRANCISCO • SEATTLE • ST. LOUIS • TWIN CITY (ST. PAUL)
Sales Offices: INDIANAPOLIS • KANSAS CITY, MO. • PHILADELPHIA • ROCKFORD, ILL. • TOLEDO • TULSA • YOUNGSTOWN

Headquarters Offices: 208 S. La Salle St.—Chicago 4, Ill.

UNITED STATES STEEL



After 24 years' service, another Exide, the new...
EXIDE-MANCHEX BATTERY

New installation of 60-cell DME-13 Exide-Manchex Battery which replaced older Exide batteries, which served a substation in southeastern Wisconsin for 24 years.

In 1925, a utility in southeastern Wisconsin installed a 60-cell EMG-7 Exide Battery. Before being replaced in 1949 by the new Exide-Manchex, it had given nearly a quarter-century of continuous service.

The new Exide-Manchex Battery operates a number of 34.5 KV oil circuit breakers and provides emergency lighting in the attended substation. Indicating lamps are on each control circuit.

For positive operation of switchgear, plus an adequate and uninterrupted supply of current for all your stationary battery requirements, use Exide-Manchex Batteries. They assure you dependable performance, long battery life and low-cost maintenance.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

You get all these in EXIDE-MANCHEX BATTERIES

The *exclusive*, long-life manchester positive plate.

Slotted plastic separators, impervious to chemical and electrical reaction.

Plastic spacers for plate alignment.

Latest development in molded glass jars.

Heavy terminal posts with copper inserts for extra conductivity.

"Exide" and "Manchex"
Reg. Trade-marks U.S. Pat. Off.

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

IMPORTANT NEW INSULATING COMPOUND

...For Low-Temperature Flexibility Down To -60 deg. C.

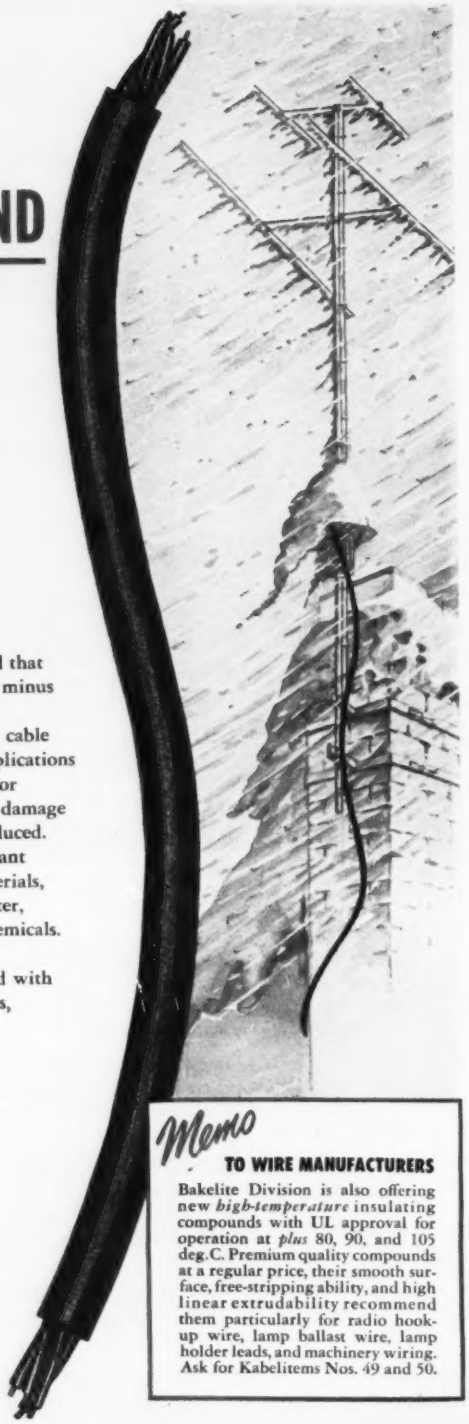
...For Jacketing Exterior Cables Used For Communications and Power Wherever Weathering Is a Problem.

A new VINYLITE Brand Plastic electrical insulating compound that remains flexible and tough even at temperatures approaching minus 60 deg. C. has been introduced by Bakelite Division.

This new addition to the line of VINYLITE Plastic wire and cable compounds is extremely weather resistant. Its outstanding applications include jacketing cables for use in cold climates such as exterior lead-in cables for rotating television antennas. The problem of damage from wind-slapping or abrasion at sub-zero temperatures is reduced.

In addition, the new compound provides the vitally important properties common to other VINYLITE Plastic insulation materials, including excellent electrical resistance, and resistance to water, mildew, oils, greases, alkalies, most strong acids and other chemicals. Flame resistant compounds are available.

For information on wire and cable of many types, insulated with VINYLITE Brand Plastics, and a list of representative suppliers, write today to Dept. JU-28



Memo

TO WIRE MANUFACTURERS

Bakelite Division is also offering new *high-temperature* insulating compounds with UL approval for operation at *plus* 80, 90, and 105 deg.C. Premium quality compounds at a regular price, their smooth surface, free-stripping ability, and high linear extrudability recommend them particularly for radio hook-up wire, lamp ballast wire, lamp holder leads, and machinery wiring. Ask for Kabelitems Nos. 49 and 50.

Vinylite BRAND PLASTICS

TRADE MARK

BAKELITE DIVISION

Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, N.Y.

What Makes A GOOD Connection?

LISTED BY UNDERWRITERS

1 **High Pressure Contact Between Wires:** It is fundamental that **high pressure** contacts are **better** electrical contacts. Also, it is necessary to have high pressure to keep the wires from sliding, rolling or moving within the connector, as the power lines sway in the wind. High pressure effectively seals the contact surfaces from moisture and oxidation and produces a lasting low resistance connection. Tests show that BLACKBURN Connectors definitely produce these high pressure contacts.

2 **Ability to Maintain This High Pressure Contact:** The connector must have sufficient strength to make and **hold** a high pressure connection. It must not yield or stretch and loosen up with time. BLACKBURN Hi-Strength Connectors are made of Duronze, a silicon bronze alloy which is actually stronger than structural steel. They positively test stronger than other connectors when pulled to destruction in a tensile testing machine.

BUILDERS OF QUALITY PRODUCTS FOR 75 YEARS

OVER 100 CONVENIENTLY-LOCATED JOBBERS' STOCKS

BLACKBURN *Hi-Strength* **CONNECTORS**

YES, BLACKBURN Hi-Strength Connectors (1) make high pressure connections and (2) have that extra strength required to *hold* the high pressure connection. It pays to use the best—it pays to use BLACKBURN Connectors.

JASPER BLACKBURN
CORPORATION
35 Madison St. • St. Louis 6, Mo.
Phone CE-3007

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

HERE'S HOW IT WORKS

View shows two sections of the "pre-ionized gap" with one cut away to show gap arrangement. The high resistance spacers allow for a constant flow of a small leakage current, which equally divides the voltage across the series of gaps. The ceramic buttons in the center have a very high dielectric constant with a resulting heavy concentration of stress across the short air gap. This creates radiation when voltage rises, ionizing the air, and conditioning the gap for uniform sparkover. The number of gaps in a particular arrester are proportionate to its rating.

An engineered exit for impulse amps!

We call it the "pre-ionized gap"... this hidden feature that assures *low and consistent sparkover* in Westinghouse Valve-type Arresters. It's exclusively Westinghouse and it offers a *sure* way to provide *complete* protection for your valuable system equipment.

In Westinghouse SV and LVS Arresters the gaps are arranged for low sparkover on impulse and high sparkover on 60-cycle voltage. The gaps are enclosed in a porcelain tube with metal caps solder-sealed on each end. Seals are pressure-tested to make sure no moisture will enter in service; and before final sealing, the assembly is purged with dried air to exclude initial moisture. There is never need for internal maintenance.

For complete information on LVS (20 to 73 kv) and SV (3 to 242 kv) Arresters, ask for bulletins DB 38-120 and DB 38-130, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-60724

New CORNING
Twin-lite Lens Panels
IN BANK OF NOVA SCOTIA BUILDING

Added Beauty
Improved Brightness Control

As one of the best examples of modern office building design, it is only fitting that the Bank of Nova Scotia Building in Toronto should be equipped with the latest thing in lightingware—new Corning Twin-lite Lens Panels. A product of Corning research, this important new medium for fluorescent lighting adds beauty and improved brightness control to any installation. The lenses in these water-white crystal lenses are scientifically designed to give a substantial reduction in side and luminaire brightness.

Corning Light-Weight Lens Panels are lower in cost than previous products of this type. For example, two 24″ frame mounted Uni-lite or Twin-lite panels will mean a saving in glass cost of nearly 12% over four of the old shorter length panels. Reduction in weight means easier mounting and installation, while the added feature of variable lengths widens the field of application.

Corning Light-Weight Lens Panels are available 11″ wide and up to 48″ in length in both Twin-lite and Uni-lite patterns. Longer lengths and special widths can be supplied on order. Take advantage of the possibilities offered by this truly new lightingware. Write for information today.

CORNING GLASS WORKS
CORNING, NEW YORK
Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING...
CORNING ALBA-LITE for diffusion of fluorescent light ... CORNING FOTA-LITE for high level illumination ... CORNING brand LENS PANELS and PYREX brand LENSLITES for prismatic light control

CORNING GLASS WORKS
Dept. EW-1, Corning, N. Y.

Please send complete information on Corning Twin-lite and Uni-lite Lens Panels.

Name_____ Title_____

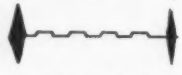
Firm_____

Address_____

City_____ Zone_____ State_____

HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.



Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.

A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

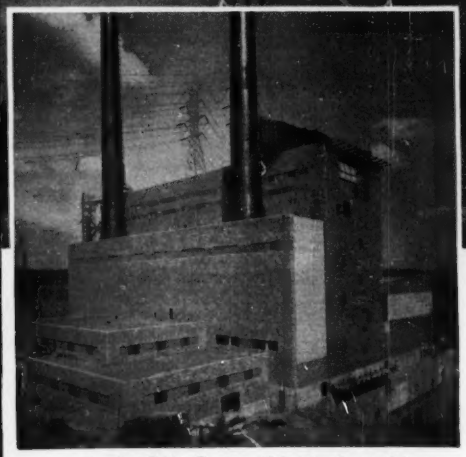
Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to *rigid* state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

GRINNELL

WHENEVER PIPING IS INVOLVED

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago
Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York
Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

A new "high" in tower dependability and economy



American Bridge Company fabricated and erected the structural steelwork for the new Philip Sporn Plant, which utilizes four of the largest steam generators in the country.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI
CLEVELAND · DENVER · DETROIT · DULUTH · ELMIRA · GARY
MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

These 240-ft. river crossing towers are among the largest in use. They're double circuit, 132 kv towers carrying six 477,000 CM, ACSR conductors and one 159,000 CM, ACSR ground wire.

"Streamlined" towers handle heavy duty job for A. G. E. System

THE tall, double-circuit towers shown above are among the approximately 160 erected to join the new 550,000-kw Philip Sporn Plant at Graham Station, W. Va., to the 132 kv transmission network of the American Gas and Electric System.

Designed and fabricated by American Bridge Company, these steel towers stand as proof of the soundness of "streamlined" towers—stripped of all non-essentials—for even the heaviest duty. Equipped with steel grillage earth anchors, they offer the added economies of simplified installation and frill-free construction that resists wind and wintry weather.

American Bridge has been designing, fabricating and erecting transmission towers for the nation's leading power companies for forty-five years. Its experience and facilities are second to none. Why not submit any questions you might have to our nearest Contracting Office? An inquiry involves no obligation.

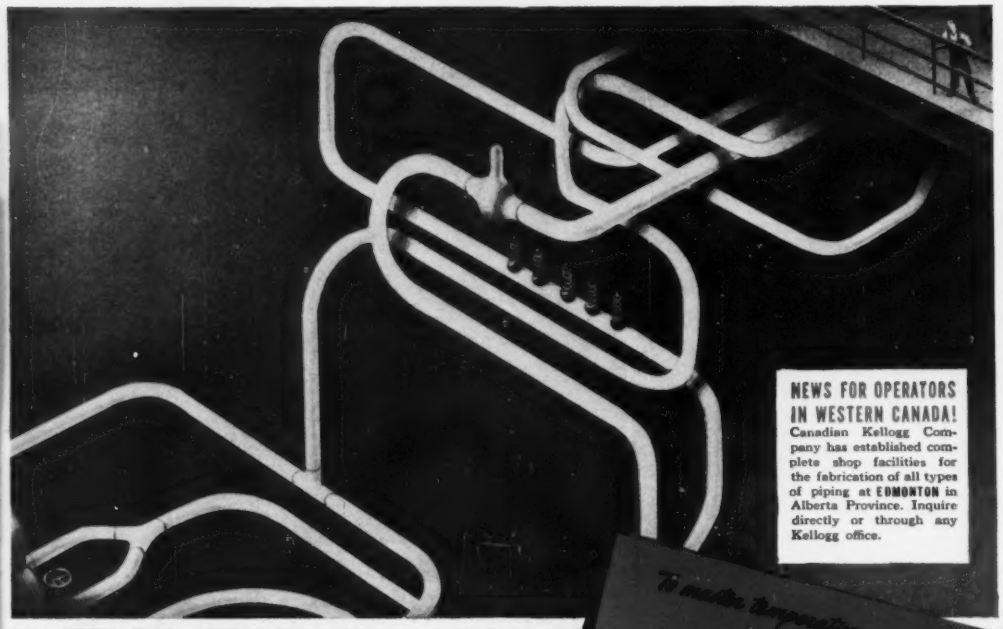
USS

AMERICAN BRIDGE

UNITED STATES STEEL

Note: Thirteen Major Reheat Units...

. . . within a short period, we have contracted to fabricate and install the critical power piping for thirteen major reheat units. These systems are for nine leading utility companies...include designs by six well-known consulting engineers...and have a total operating capacity of more than 1,150,000 kws. In addition, Kellogg power piping has been specified for many traditional-type installations in the U.S., Canada, Europe and South America.



NEWS FOR OPERATORS IN WESTERN CANADA!
Canadian Kellogg Company has established complete shop facilities for the fabrication of all types of piping at **EDMONTON** in Alberta Province. Inquire directly or through any Kellogg office.

To make temperature, pressure and chemicals safe
M. W. KELLOGG
piping and process equipment

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

M. W. KELLOGG
50th ANNIVERSARY
1901 - 1951

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

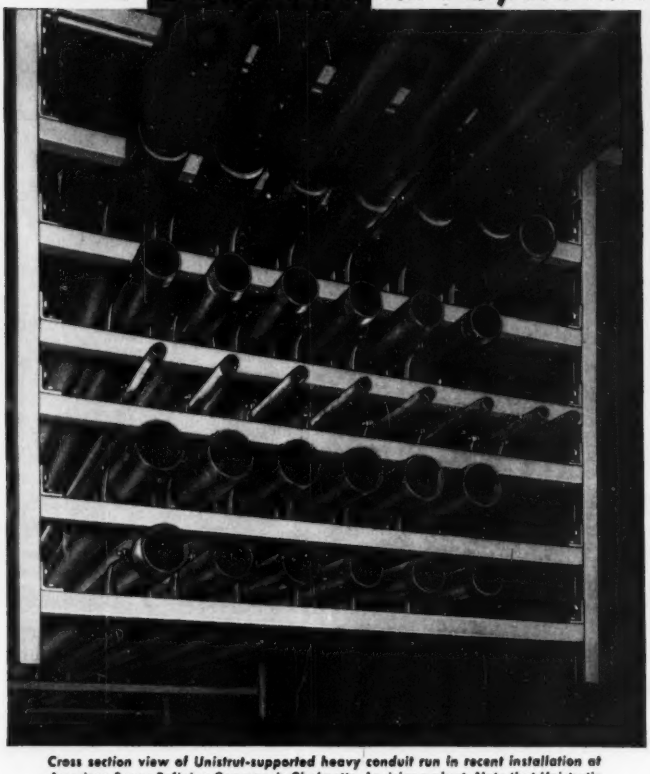
Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Bends and Headers
Giant One-Piece Bends
Forged and Welded Fittings
Radial Brick Chimneys

★

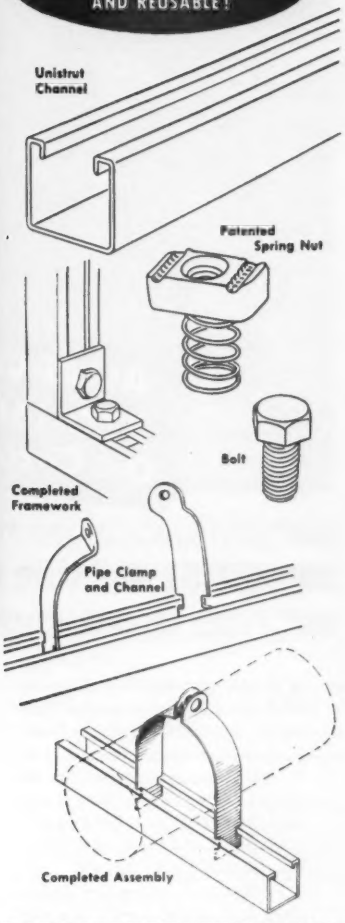
The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman Incorporated) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

Rack Heavy Runs of Conduit

with UNISTRUT All-Purpose Metal Framing!



NO DRILLING · NO WELDING
100% ADJUSTABLE
AND REUSABLE!



Cross section view of Unistrut-supported heavy conduit run in recent installation at American Sugar Refining Company's Chalmette, Louisiana plant. Note that Unistrut's flexibility makes possible later additions or changes.

Try completely adjustable Unistrut framing the next time you have a pipe or conduit racking job. It's easy to use, requires little detailing time, fast to erect, and is capable of supporting great weight. It's trim framework, neat in appearance.

Unistrut's flexible design permits extreme accuracy of installation—adjustability to a fraction of an inch. Additional framework, clamps, or hangers may be added at any time quickly and easily, *without disturbing existing runs.* No drilling, no welding, no special tools or equipment needed. Unistrut saves time and money in erection and maintenance.

Representatives and Warehouse Stocks in Principal Cities consult your Telephone Directories.

U. S. Patent Numbers
2327587 2363382
2329815 2380379
2345650 2405631
Other patents pending

UNISTRUT

The World's Most Flexible All-Purpose Metal Framing

FREE CONSTRUCTION CATALOG AND WALL CHART Write today for your copy of 24 page Construction Catalog No. 500 and 24" x 36" Wall Chart!

UNISTRUT PRODUCTS COMPANY
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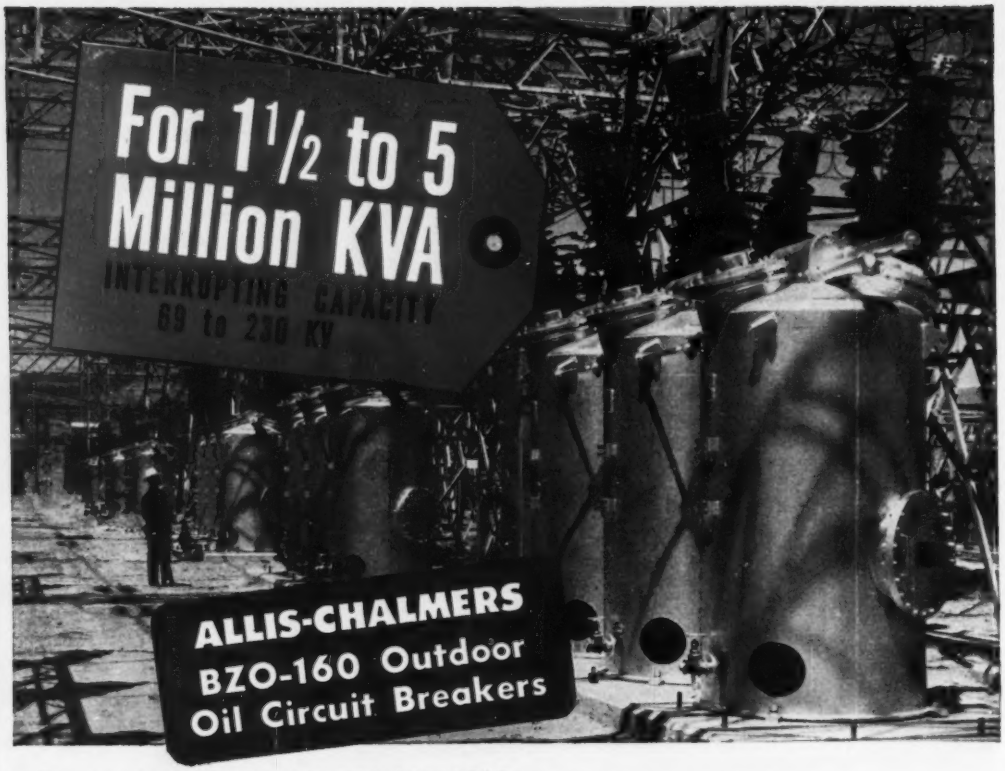
Please send the items checked below, without obligation:
☐ Catalog 500 ☐ Wall Chart ☐ Unistrut Sample

Name_____
Company_____
Address_____
City_____ Zone_____ State_____



MECHANICALLY TRIP-FREE OPERATOR *affords high-speed opening*

RELIABLE HIGH SPEED FAULT CLEARING AND FAST RECLOSING *for system needs*

EVERY BREAKER COMPLETELY FACTORY ASSEMBLED AND TESTED *before shipping*

MAINTAIN continuity of power service despite transient line faults. The BZO-160 oil circuit breaker clears system faults in 3 to 5 cycles and recloses within 20 cycles to give you protection in ratings 69 kv and higher. Get long-life performance and reliable protection with these BZO-160 features:

1) Mechanically trip-free design gives high-speed contact opening under all operating conditions. Pneumatic operator is uncoupled from the contact mechanism through a positive mechanical linkage. This means that contacts open independent of closing piston position.

2) *Ruptor* interrupter gives split-second arc extinction . . . interrupts load and fault currents with low arc energy release. Reduces oil and contact deterioration to a minimum. Arc resistant alloy contact tips give long contact life with little maintenance.

The BZO-160 performance is based upon more than 50 years of circuit breaker design and manufacturing experience, exacting laboratory and field tests, and years of power service. Simple breaker construction, free of complicated mechanisms, makes inspection easy.

For more information on dependable BZO-160 performance call your A-C sales office or write for new bulletin 71B6022C. A-3074

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.

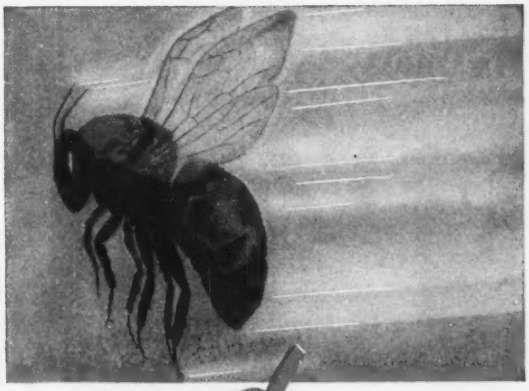
STANDARD RATINGS

Rated KV	Rated Amp. 60 cycle	KVA Interrupting Capacity*
69	1200	2,500,000
69	2000	3,500,000
115	800	1,500,000
115	1200	3,500,000
138	800	1,500,000
138	1200	3,500,000
138	1200	5,000,000
161	800	3,500,000
161	800	5,000,000
230/196	800	3,500,000
230/196	800	5,000,000
230	800	3,500,000
230	800	5,000,000

*For information on higher interrupting ratings, get in touch with your A-C sales office.

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

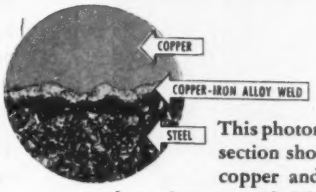


proved -a million times!

According to the aerodynamic theories of a few years ago, it was impossible for the bumble bee to fly. Its body was too heavy for its wings. Despite this handicap, bumble bees by the millions refused to be grounded.

Before 1915, copper and steel had never been successfully integrated and doubters said that a practical method would never be found. The different melting points and the varying expansion rates of these two metals had presented too much of a problem. Then Copperweld Steel Company developed the Molten-Welding Process, and presented industry with the first successful copper-covered steel wire. Today, the millions of miles of Copperweld Wire in service have proved that Copperweld provides the highest standards of efficiency at lowest annual cost.

In the Molten-Welding Process, molten copper is poured around a heated alloy steel billet under carefully controlled temperatures and casting conditions.



This photomicrograph of the weld section shows how the crystals of copper and steel form a permanent and continuous weld. The perfect interlocking of these two metals, accomplished only by Molten-Welding, provides rugged strength, high conductivity, rust-resistance and long life.

Tensile strengths up to 180,000 pounds per square inch are attained with the special alloy steel used in Copperweld Wires. And these strengths are permanent because the steel is always protected by a heavy copper covering of uniform thickness.

Today, with the copper shortage increasingly acute, Copperweld offers definite savings in both copper and dollars for many applications. It uses steel for strength —and only enough copper to do the job copper does best—conduct electricity and resist corrosion.

COPPERWELD STEEL COMPANY • Glassport, Pa.

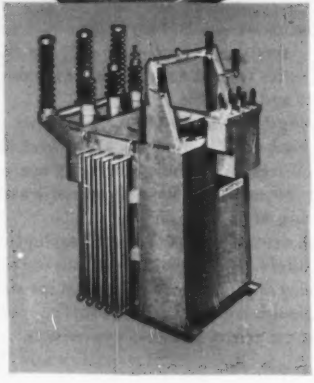
Sales Offices In Principal Cities

Copperweld TRADE MARK **PRODUCTS**

• POWER CONDUCTORS • GUY & MESSENGER STRAND • OVERHEAD GROUND WIRE • GROUND RODS & CLAMPS • COUNTERPOISE WIRE • TELEPHONE LINE WIRE • TELEPHONE DROP WIRE • WEATHERPROOF WIRE • SIGNAL LINE WIRE • SIGNAL BONDS • INSULATOR TIES • NAILS & STAPLES • FENCE & BARBED WIRE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



The JUNIOR "CSP"

POWER TRANSFORMER

NEW ECONOMY

. . . for small capacity substations

Here's the substation that fills a long apparent need in the power distribution field . . . a smaller, yet complete, substation with integral high and low-voltage switchgear as well as metering equipment. And what's more, it's "CSP" (Completely Self-Protecting), with both thermal and lightning protection built in.

Designed for small towns and similar areas where the capacity of the feeder does not justify a larger rated "CSP" Power Transformer, the new "CSP" JUNIOR provides all the advantages of compactness, simplicity and ease of operation . . . PLUS *low cost.*

Available in 300 to 1000-kva ratings. For further information on all ratings of "CSP" Power Transformers, contact your Westinghouse representative, or write for Booklet B-4692. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, J-70572-A

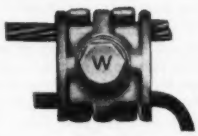
Westinghouse

TRANSFORMER EQUIPMENT

MAKE A *Good Connection* WITH WEAVER

1-WS
Copper to Copper
(Also available for general purpose use —1-WS-C)

WSB-C
Cadmium Plated
General Purpose
(Also available for copper to copper connections—a WSB)



K-1 Jumper Clamp
(Also available for aluminum, steel, or copper to similar conductor.)

A-111 Armor Rod Jumper Clamp
(Also available for aluminum to aluminum connections.)

HIGH STRENGTH CONSTRUCTION THROUGHOUT — WEAVER HOT LINE CLAMPS are cast of high strength ELECTRO-BRONZE. This exceptionally strong metal is specially alloyed in our own electric furnaces so that each operation from melting to final assembly is quality controlled.

MAKE BETTER CONNECTIONS — With WEAVER HOT LINE CLAMPS you are assured of high pressure connections, since ELECTRO-BRONZE produces low friction, free running threads which efficiently convert more of the tightening torque to pressure on the conductor — without distortion — and there is no freezing of the tightening bolt with ELECTRO-BRONZE.

COVER LARGE WIRE RANGE — The popular catalog #1WS, for instance, accommodates number 6 to 4/0 stranded main and number 6 to 2/0 tap — this feature cuts inventory.

DESIGNED TO STAY TIGHT — Both main line and tap wire connections are secured with SHAKEPROOF lockwashers to provide permanent, trouble-free connections that won't loosen under vibration.

FOR TOP QUALITY AT LOWEST COST . . . YOU CAN'T BEAT WEAVER HOT LINE CLAMPS!

Write for the latest Weaver Catalogue

JAW

J.A. WEAVER CO.

2110 HOWARD ST · ST.LOUIS, MO · CE. 0881

CORNELL-DUBILIER CAPACITORS
FOR POWER-FACTOR IMPROVEMENT

Another Cornell-Dubilier Field Performance Record:

491 MILLION KVAR HRS.

OF TROUBLE-FREE CAPACITOR SERVICE

FOR T.V.A!

This record of 491,961,600 Kvar hours of dependable field service is typical of more than 4,000 C-D power-factor installations made in the past decade. Among the many reasons why Cornell-Dubilier capacitors have given so many years of trouble-free service under the severest operating conditions is Cornell-Dubilier's engineering standard which provides for the lowest dielectric unit stress and highest major insulation level.

Called upon to supply enormous quantities of power to vital government plants in the area, TVA is extremely "power-factor conscious." Installation shown is at the Southern Ferro Alloys plant. The large open type furnace (in background), runs well over 3000°F. This, plus the summer sun, corrosive fumes, etc., is a most severe test of this capacitor installation's ruggedness.

HERE'S WHY C-D CAPACITORS STAND UP IN THE FIELD

- **Wide margin maintained between paper and foil coordinated with major insulation to provide highest impulse level.**
- **Sturdy steel tension equalizing band and rigid end plates insure uniform distribution of stack pressure.**
- **Laminated insulation between case and sections insure high safety-factor for transient voltages.**
- **Lowest dielectric unit stress.**
- **All C-D capacitors from 230 to 13,800 volts in all sizes are given an energization test as a form of quality control, by applying full rated voltage for period of time sufficient to establish ultimate heat rise.**

C-D capacitors can also be provided in weatherproof housings, switched or unswitched and completely assembled for energizing at the field site to meet specific sub-station needs. Your inquiries are cordially invited. Our field engineers will be glad to discuss the many dollar and maintenance saving characteristics of Cornell-Dubilier capacitors.

CORNELL-DUBILIER
CAPACITORS
BEST BY FIELD TEST

Cornell-Dubilier Electric Corp., South Plainfield, New Jersey.

***Other plants:** New Bedford, Worcester and Brookline, Mass., Indianapolis, Ind.; Providence, R. I. and Cleveland, Ohio.*

Double Protection

Turbines Require Double Protection from Dirt and Water

Turbines require protection from two different causes of lubrication failure—***dirt*** and ***water***. Removal of dirt alone does only half a job. That is why De Laval Oil Purifiers are so much more effective for maintaining turbine oil than any other means available. They instantaneously remove solid foreign matter and also any moisture that may be present.

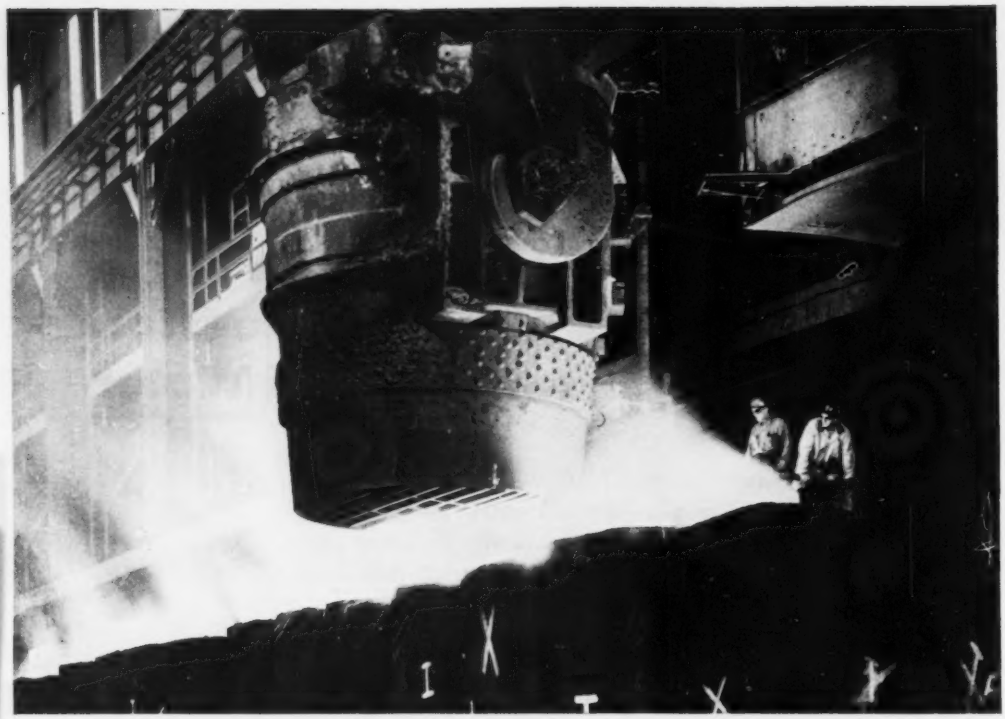
It is extremely important to get ***double protection*** when you purify turbine oil, for water is the real trouble-maker as often as not. For example, condensate in oil leads directly to the formation of sludge, and of course there is always the possibility of a major water leak which might lead to serious emulsification and very real trouble.

De Laval Oil Purifiers do not remove oil-soluble additives; action within the centrifuge is entirely mechanical.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

LUBRICATING OIL PURIFIERS



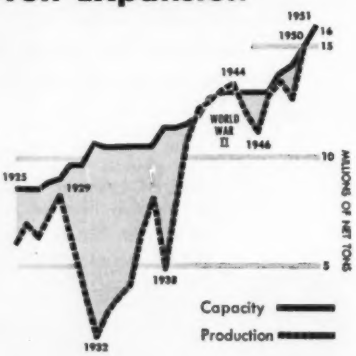
MILLION TONS MORE STEEL

Latest Increase in Bethlehem's Annual Capacity Climaxes 5 Years of Postwar 3,100,000-Ton Expansion

On January 1 of this year Bethlehem's steel making capacity stood at 16 million ingot-tons annually—*an increase of 1 million tons* over a year ago.

Since the war ended we have increased our annual steelmaking capacity *3,100,000 tons, or 24 per cent.*

Moreover, as the chart at the right shows, Bethlehem's steel capacity has nearly doubled in 25 years. Additional capacity can and will be created as it is needed.



BETHLEHEM STEEL ★ BETHLEHEM STEEL ★

Split Second Protection
High Surge Discharge
Long Life!

Low Voltage Drop—Extremely Marked Valve Action . . .

Speed and superior valve action of Crystal Valves have set a high standard of lightning protection for the world's power lines.

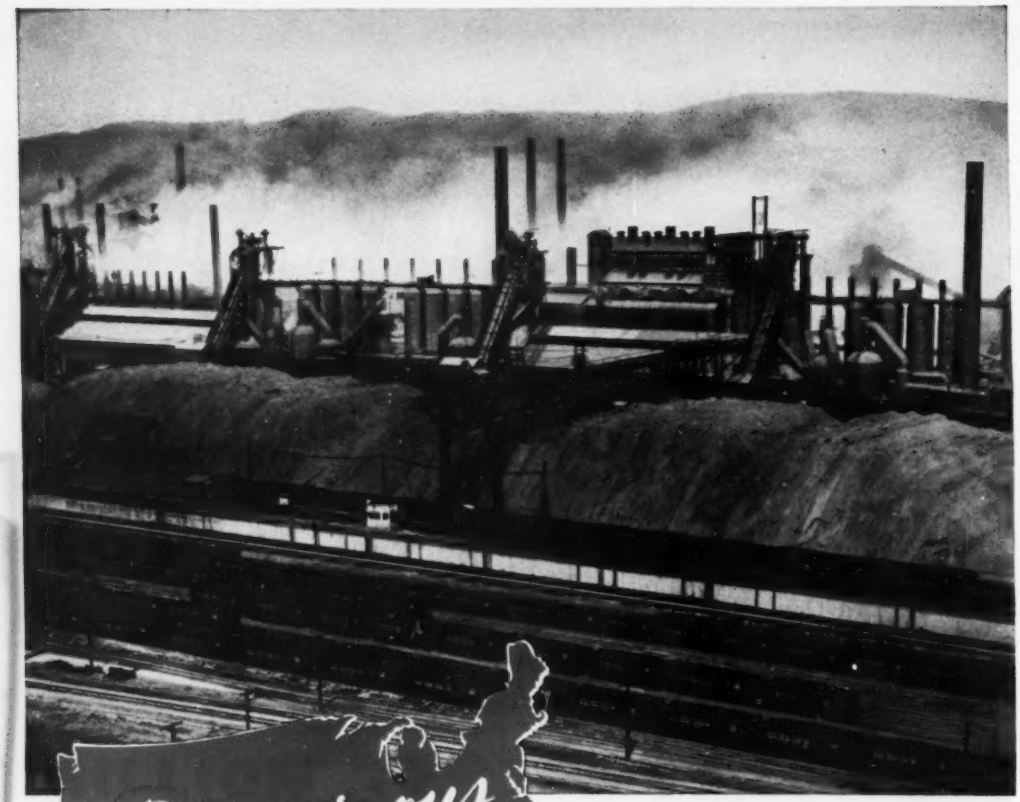
Crystal Valves stand guard over equipment and service at all times. Their weatherproof construction withstands the heat of summer . . . the cold of winter, thus assuring long life split second protection. Crystal Valve research offers:

- **Gasketed copper sealing cover.**
- **Line lead moisture shield.**
- **High-speed multi-gap structure.**
- **Accurately ground Steatite spacers.**
- **Oxidized Silicon Carbide Valve Element.**
- **Wet process porcelain body and cap.**
- **Drip petticoats on cap and body.**

Get the latest technical data on lightning arresters and their installation. Write for new Electric Service catalogue. No obligation. Yours for the asking.

ELECTRIC SERVICE MANUFACTURING CO. • 1709 Cambria St. • Philadelphia 32, Penna.

CRYSTAL VALVE
LIGHTNING ARRESTERS



Bituminous

is indispensable to the power of America

The bituminous coal industry
has the strength—the know-how—
to meet *any* challenge.

Only with indispensable bituminous
can the greatness of America be maintained.

For excellent bituminous coals
to meet your every need,
Ask our man!

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—**better!**

LINKING 13 GREAT STATES WITH THE NATION
B&O

Replacing Secondaries?

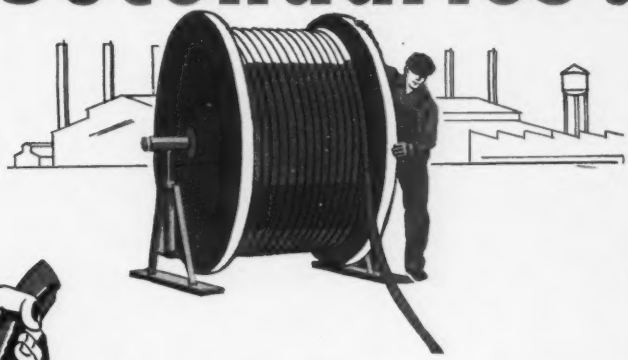


figure them in aluminum and

figure low

Secondaries, service drops, feeders, recircuiting—no matter what the job, figure it both ways—in aluminum and copper. You'll find big savings can be made with Alcoa Aluminum!

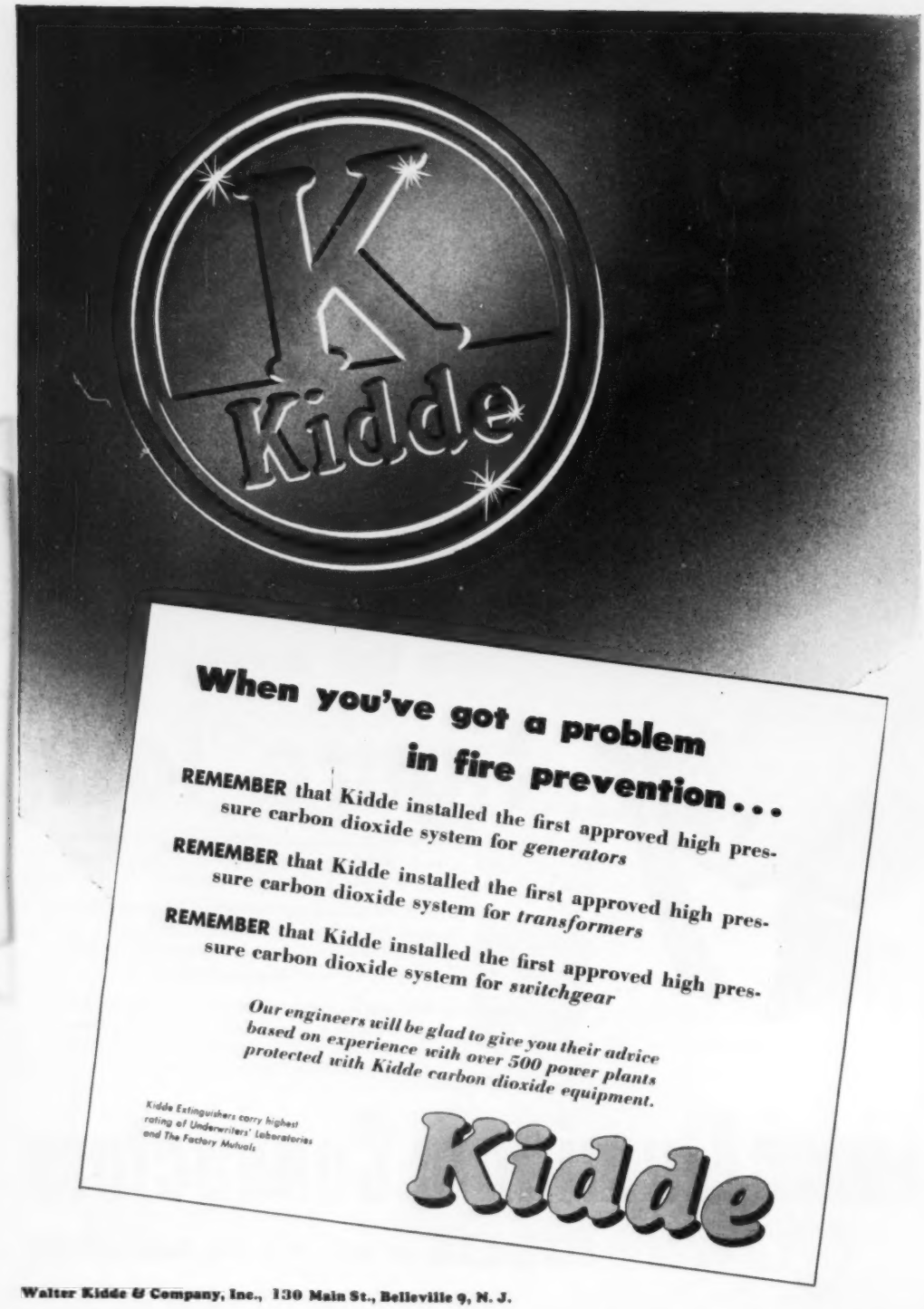
Although the rearmament program prevents unrestricted sale of aluminum and copper, we are ready to help you with the planning required for projects involving electrical wiring.

FREE INSTALLATION BOOK—Write for your copy of this "Questions & Answers" book on aluminum conductor and installation. Address: ALUMINUM COMPANY OF AMERICA, 1776A Gulf Building, Pittsburgh 19, Pennsylvania.

Insulated **Aluminum Conductors**

ALCOA ALUMINUM

of ALCOA EC ALUMINUM are made by leading manufacturers



When you've got a problem in fire prevention . . .

REMEMBER that Kidde installed the first approved high pressure carbon dioxide system for *generators*

REMEMBER that Kidde installed the first approved high pressure carbon dioxide system for *transformers*

REMEMBER that Kidde installed the first approved high pressure carbon dioxide system for *switchgear*

Our engineers will be glad to give you their advice based on experience with over 500 power plants protected with Kidde carbon dioxide equipment.

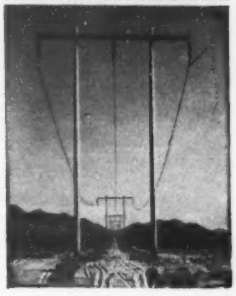
Kidde Extinguishers carry highest rating of Underwriters' Laboratories and The Factory Mutuals

Kidde

Walter Kidde & Company, Inc., 130 Main St., Belleville 9, N. J.

HIRED! A field man

FOR YOUR GOOD RELATIONS DEPARTMENT



Highest Quality Wet-Process Porcelain Shells made on the industry's finest automatic, completely hydraulic presses to assure uniformity and dependability in ALL units.

Not all good relations with the public are confined to the home office. Basically, it starts with the kind of equipment you use. Power failures won't make friends—only influence people to say adverse things about your service. Stay on the "Good" side of Good Relations. Buy Porcelain Products' dated, performance tested suspension insulators. They're built to keep working under the most extreme weather conditions. Write for prices and catalog information on our High Voltage Insulator line.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

EXPORT REPRESENTATIVE:

Philips Export Corp., 100 E. 42nd St., New York 17, N. Y. U.S.A. Cable Address: "PHILYORK"

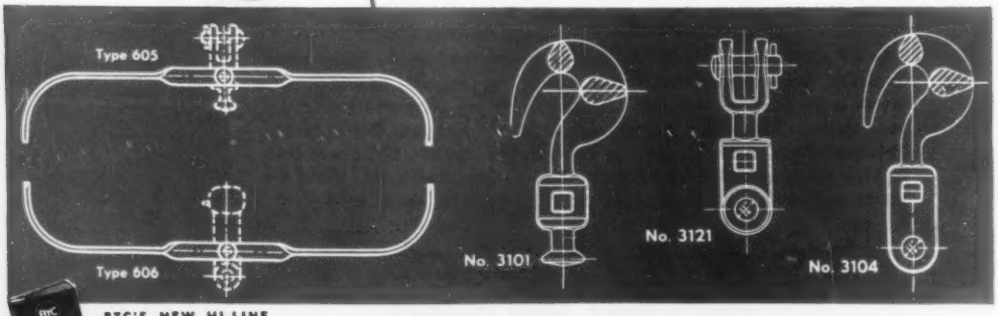
BTC ...THE COMPLETE LINE

Arcing Horns & Support Fittings

The use of Simple Flat or Round Steel Arcing Horns is an economical method of minimizing danger of flash-over damage to conductor and insulator string.

Standard Arcing Horns including the easily-applied Single-Bolt Type as well as Drop Forged Steel Fittings for their attachment on Ball Socket and Clevis Type Insulator Strings, are part of **BTC'S COMPLETE LINE.** Full information will be found in the new BTC Hi-Line Catalog Number 6, which can be secured on request.

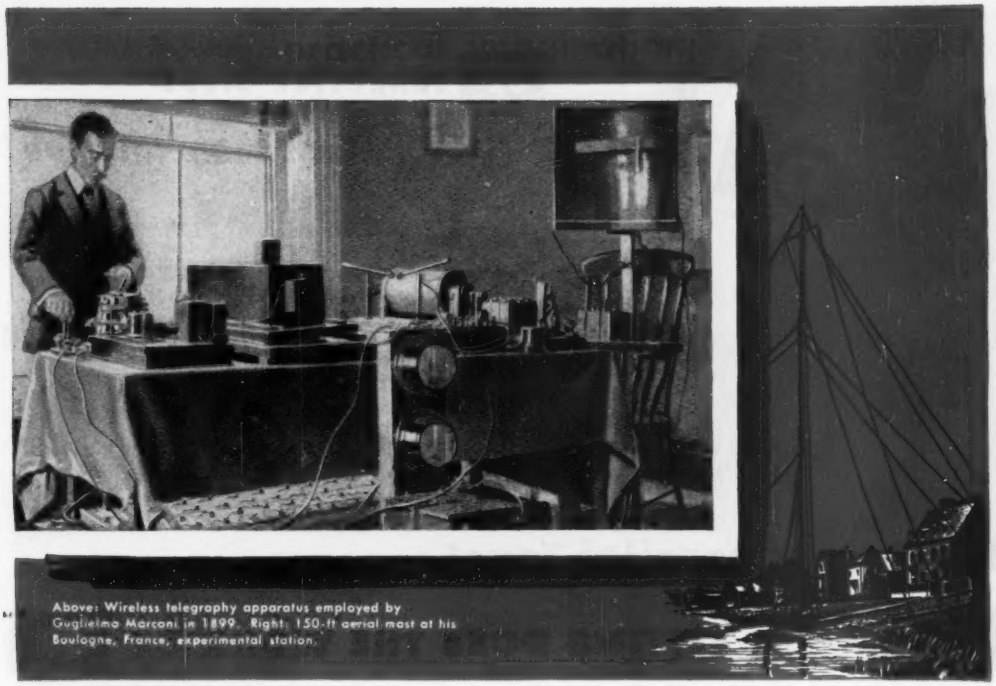
Special Arcing Horns and Rings. . . . BTC is prepared to design and produce special Curled-End or Spherical-Tipped Horns, as well as Arcing Rings made from flat, round, structural or tubular steel. Drop Forged Steel Fittings for their support also can be provided. Dies and tools are available for several special designs . . . your inquiry is invited.



BTC'S NEW HI-LINE CATALOG, showing its complete line of transmission line hardware, is available on request. Write for your copy today.

Sold Through Your Insulator Manufacturer Only

THE BREWER-TITCHENER CORPORATION, Cortland, N. Y.



Above: Wireless telegraphy apparatus employed by Guglielmo Marconi in 1899. Right: 150-ft aerial mast at his Boulogne, France, experimental station.

Rendezvous With MASTERY

1899—and a young man, near Boulogne, France, presses the key of a transmitter. Instantly, his message clicks out on a receiver in Dover, England—32 miles distant. The way has been opened to mastery of instantaneous, world-wide communication.

1899—and a Board of Directors of an infant firm, convening for its initial meeting in Newark, N. J., hears the Treasurer state that $1,400 is at the disposal of Driver-Harris Company with which to commence business. The way has been opened to mastery of new facts and techniques which will provide industry with quality metal products never before available.

"Wireless" has been developed with phenomenal speed since the day Marconi's message was successfully transmitted from Boulogne. Within fifty years—as radio, television, and radar—it has been made to circle and serve the world.

And Driver-Harris, expanding within the same fifty years until represented on all five continents, has produced many of the alloys required. For example: Gridnic* for electron tube grid wire, alloys for radio cathode sleeves and glass seal metals, Karma* and D-H Manganin for resistors, and universally famous Nichrome* and Nichrome V for resistors, plates and other components.

Today, Driver-Harris' specialized knowledge and extensive facilities are employed in supplying superior alloys for a host of applications in numerous fields. The name "Driver-Harris", indeed, has become so widely accepted as a synonym for quality that the demand for D-H products is engaging the resources of the firm to an unprecedented extent. Driver-Harris can only say it is utilizing all the mastery at its command to meet this exceptional demand as fully as possible.

Makers of Nichrome and over 80 other alloys for the electrical, electronic, and heat-treating fields.

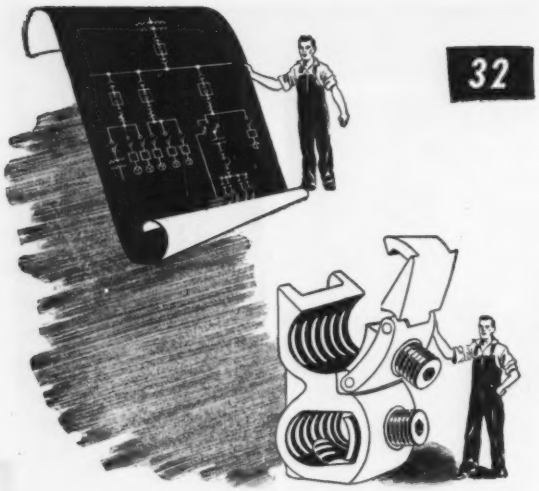
Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T.M. REG. U. S. PAT. OFF.



32 connector sizes needed on this job!

One connector size is plenty with this new XTP!

For Tee or Parallel Taps!

ONE O. Z. FITTING DOES THE WORK OF 32

One typical XTP connector replaces up to 32 different parallel or tee connectors because each XTP accommodates a wide range of wire sizes. All told, the XTP line of but 25 connectors will receive *over 400 wire-size combinations!*

For either tee or parallel taps, just snap special hinged clamp over main and tighten—the connector is permanently in place, positive contact assured. When you're ready to connect the tap, simply insert wire in tap end of connector. A wrench-turn or two and the job's done!

25 CONNECTOR SIZES do practically all tap jobs.
- Accommodate over 400 combinations of wire sizes
- Fit wire from #8 to 1,000,000 CM

HINGED CONSTRUCTION for quick installation.

SPRING STEEL LOCKWASHERS (tin plated) maintain pressure.
- Hold resiliency—assure permanent connection

PRESSURE PLATES designed for maximum contact and grip.
- Serrated for firm grip
- Can not rotate during installation

HIGH STRENGTH, HIGH CONDUCTIVITY.
- High conductivity copper alloy for body
- Extra strength copper alloy for pressure plates and hinged parts

Get these new combination fittings from your wholesaler now . . . and put an end to bulky assortments of tap connectors.

CONDUIT FITTINGS • CABLE TERMINATORS
CAST IRON BOXES • SOLDERLESS CONNECTORS
GROUNDING DEVICES • POWER CONNECTORS

XTP as a "T" tap

XTP as a parallel tap

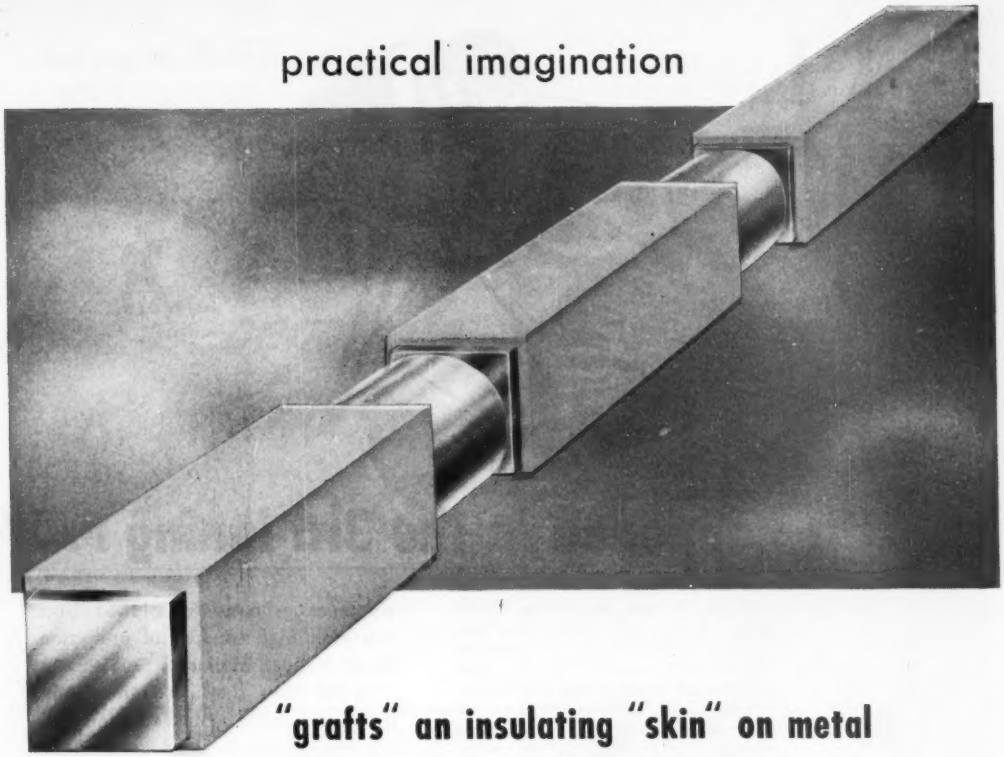
They're O. K. if They're O. Z.

Ⓡ 861

O. Z. ELECTRICAL MANUFACTURING COMPANY

262 BOND STREET · BROOKLYN 2, N. Y.

practical imagination



"grafts" an insulating "skin" on metal

Here is another example of the practical imagination C-D engineers can put to work to solve your problems. In this case a heavy electrical connector had to be covered with a safe, efficient insulation. The material best suited to do the job was C-D Dilecto.

The next requirement was to make this insulation an integral part of the whole piece. Here is where practical imagination went to work. The solution was to laminate and mold the Dilecto directly on the metal bar.

When you have a problem involving plastics—whether it is simple or complex—be sure to check with C-D engineers for a practical, unbiased recommendation. They can choose the material best suited to your needs from a wide range of grades of five basic plastics to give you any combination of mechanical, electrical or chemical characteristics. A call to your nearest C-D office will bring you this kind of help any time—all the time.

your partner in producing better products

DILECTO (Laminated Thermosetting Plastic)
CELORON (Molded High-Strength Plastic)
DIAMOND FIBRE (Vulcanized Fibre)
VULCOID (Resin Impregnated Fibre)
MICABOND (Bonded Mica Splittings)

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Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK 15 DELAWARE

"It happened in the 3rd inning . . ."

It was the first day of the World Series. A big razor manufacturer had paid some $800,000 for the rights to televise the games. It was the third inning—and the Yankees and Phillies were tied 0 to 0. Millions of fans were glued to their sets when—pfft!—three million sets went black, and for twenty minutes there was no game insofar as television was concerned! What happened?...I don't know—that's for the sponsor and the broadcasting company to decide. But you can bet your bottom dollar that it was some little thing—like insulation at a vital point—that caused the breakdown!

In electrical insulation, the price of failure is severe—product breakdown, rejects, lost time and labor.

That's why you find BH "649" Fiberglas Tubing and Sleeving in equipment that must not fail—jet planes, electronic equipment, engines. Manufacturers of home appliances and industrial equipment, who insist on BH "649", get this same high measure of protection for their tough insulation problems.

In BH "649" they get an insulation that is toughened against abrasion, will not support combustion. Stays supple after baking 12 hours at 300°F. Does not crystallize at −67°F. Unaffected by grease and oil. Speeds production because it cuts without fraying, spreads to cover knobs and terminals.

BH "649" is one of a family of BH-insulations, each designed to meet particular conditions in service. Give us a few facts about your requirements—product, temperatures, voltages. We will furnish production samples for testing.

Address Dept. W-3

Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH *Fiberglas** SLEEVINGS

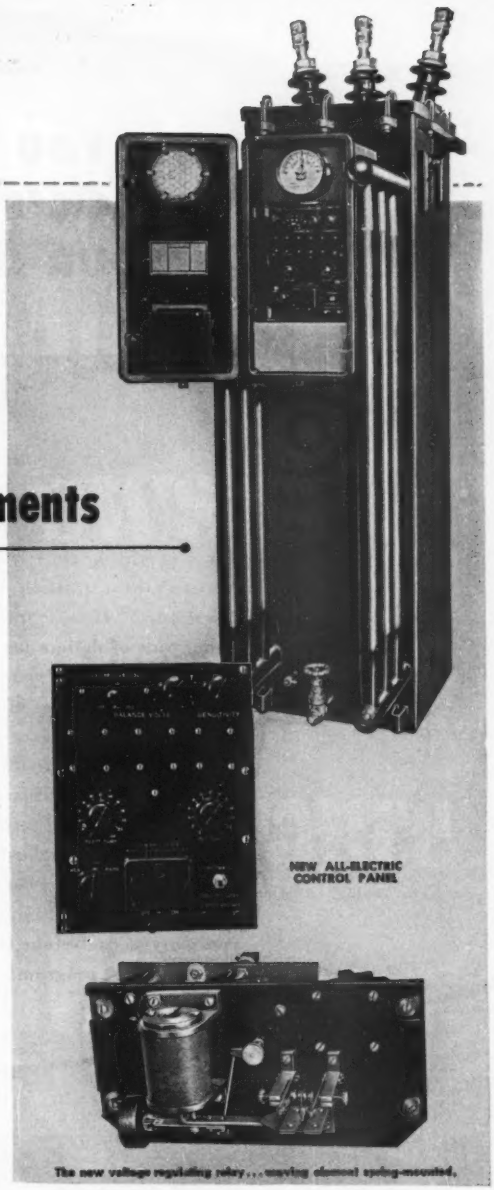
*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

More Dependable Regulation

without Mechanical Adjustments



The new voltage regulating relay . . . moving element spring-mounted.

Easier to operate!
Greater freedom from maintenance problems!
The new Westinghouse Induction Regulators give even more dependable regulation, with an all-electric control that eliminates mechanical adjustments.

All-electric control . . . easy to adjust:
Balance voltage and band width are determined by position of calibrated knobs and tap plug. That's all there is to it. Adjustments may be made without disturbing the line-drop compensator; either setting may be changed without interrupting service.

Rugged spring mounting eliminates delicate bearings:
Here's a nuisance maintenance problem licked! No more risk of trouble from mechanical bearings.

Spring-mounted . . . snap-action elements:
Motor operating relay has all moving parts spring-mounted, arranged to eliminate all armature impact . . . assures long life.

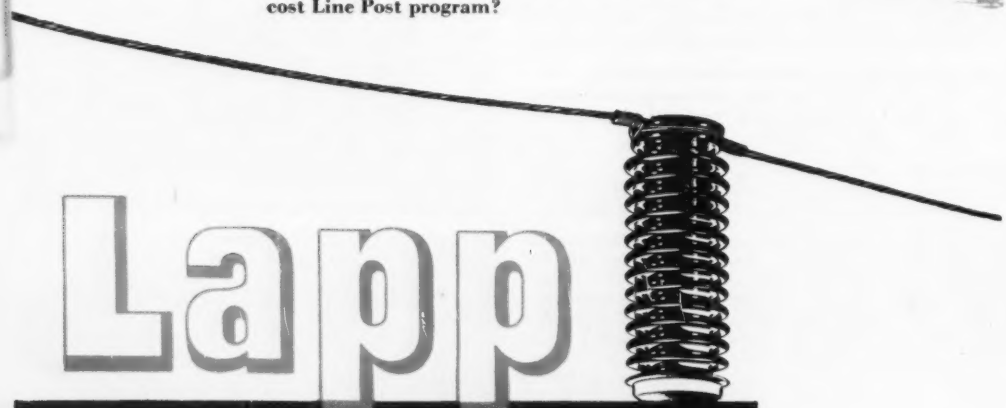
"Lifetime" contacts:
Another maintenance headache cured! Heavy silver contacts are designed to last the life of the unit.

Available in three models to meet all urban station requirements. Type SU, oil cooled. Type SA, air cooled. Type SI, Inerteen (R) cooled. For further information, ask your Westinghouse representative for a copy of B-4736, *Westinghouse Voltage Regulators for Urban Substations,* or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.
J-10351-A

Westinghouse
VOLTAGE REGULATORS
for ANY system

IF YOU HAD TO STACK 'EM ALL IN YOUR OFFICE...

Do you think that your system is one which "doesn't have trouble with high-voltage pin-type insulators?" If so, it might be worth a good many thousands of dollars per year to your company to have you take a real good look at your maintenance records. The number of pin-type insulators which have to be replaced every year—and the man-hours required to replace them—add up to an annual bill probably a great deal larger than you suspect. And it's a bill that could be cut to a tiny fraction of its present size by standardizing on Lapp Line Posts. There's a 19-year service record back of Lapp Line Posts to back up this fact. Isn't it time for *your* company to undertake the high-preformance low-cost Line Post program?



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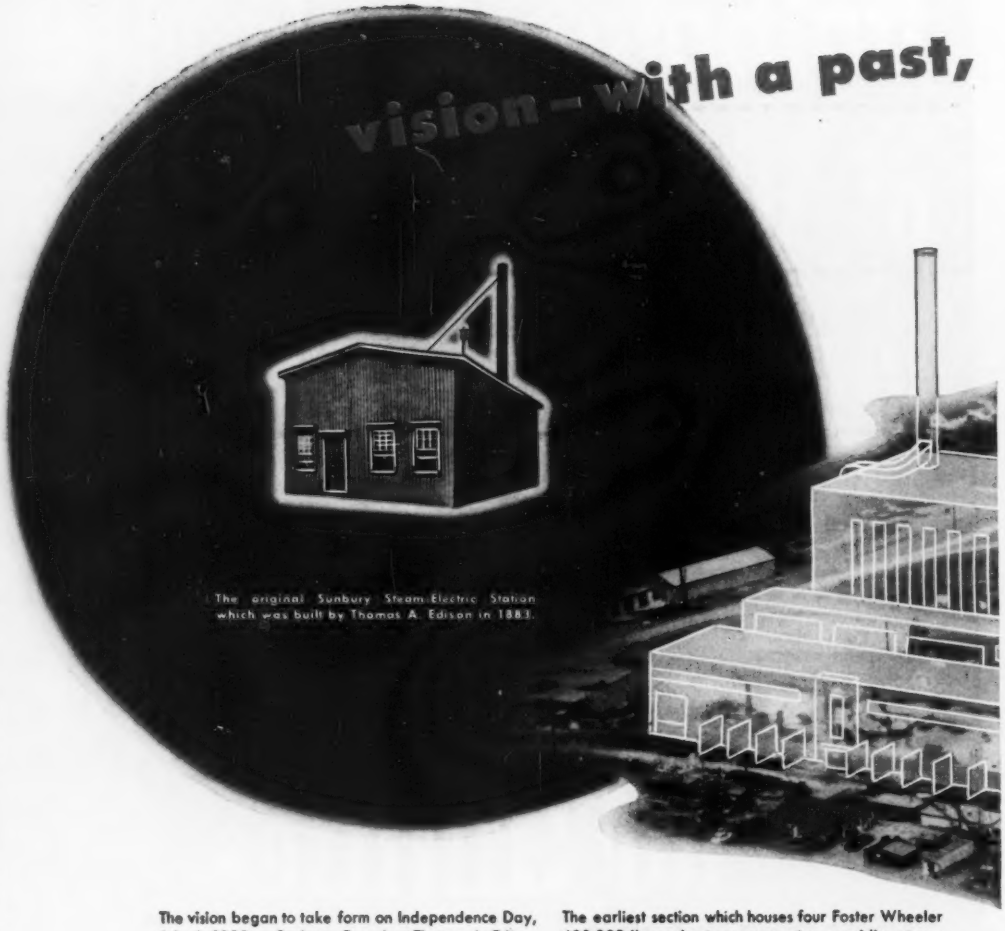
LAPP INSULATOR COMPANY INC., LEROY, NEW YORK

Hotpoint's Development of All Major Appliances for Tomorrow's All-Electric Home offers Future Load Insurance for Utilities

With an eye to the future, Hotpoint's effective promotion of electrical living is creating faster acceptance for major appliances now in the introductory stage*. This, plus the unprecedented number of today's demand appliances being sold by Hotpoint, offers utilities load insurance for the future . . . when greater load and load balance will be needed.

UTILITY DIVISION
hotpoint Inc.

vision – with a past,



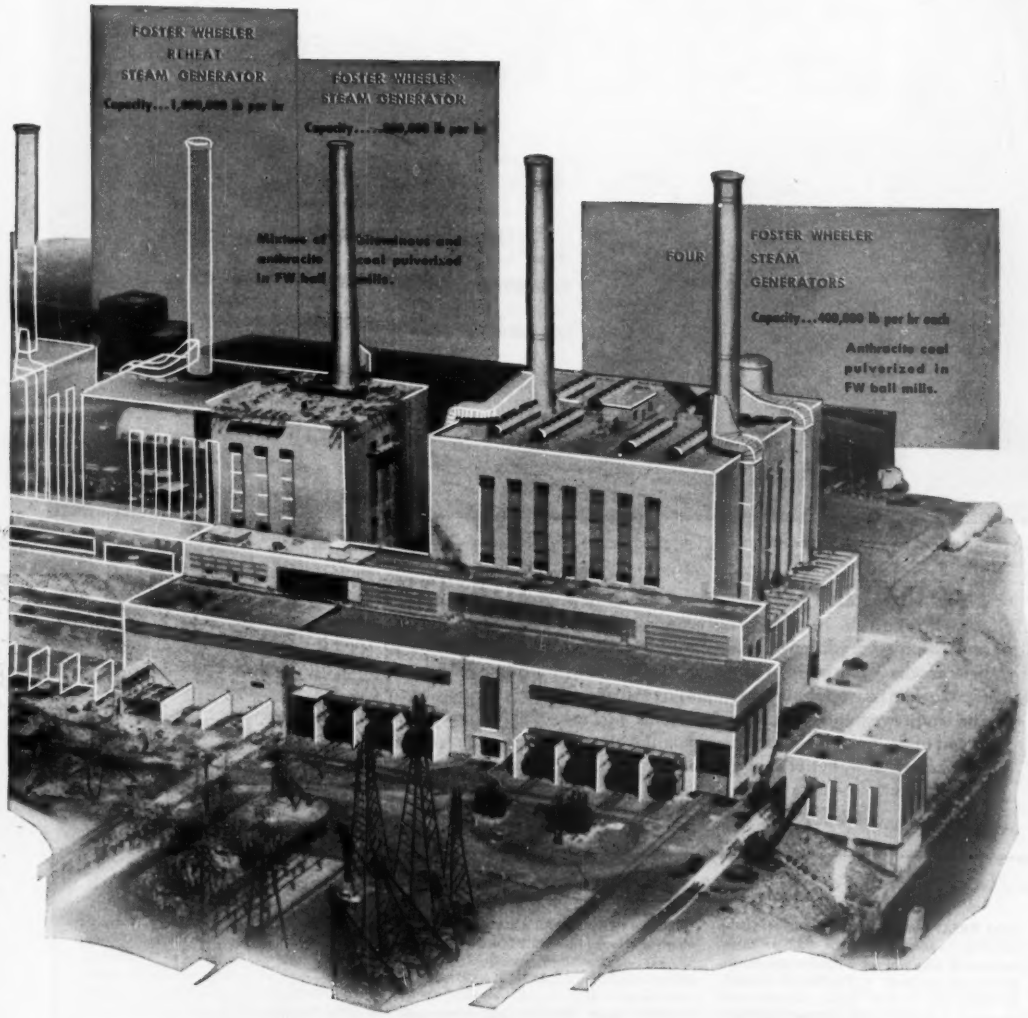
The original Sunbury Steam-Electric Station which was built by Thomas A. Edison in 1883.

The vision began to take form on Independence Day, July 4, 1883 at Sunbury, Pa. when Thomas A. Edison threw the switch of the first commercial steam-electric station in the world. This was one of the epochal events foreshadowing the scientific, industrial, and economic miracles of the 20th century. The new Sunbury Steam-Electric Station near Sunbury, Pa. reflects both the tradition of our American past and the hope of tomorrow as its fine buildings emerge from the blueprint stage to provide an abundant source of power for factories, offices, farms, and homes in Central Eastern Pennsylvania.

The earliest section which houses four Foster Wheeler 400,000 lb per hr steam generators providing steam for two 75,000 kw turbine generators is the world's largest power plant burning pulverized anthracite. The first extension houses a 100,000 kw turbine generator and an 800,000 lb per hr Foster Wheeler steam generator. Engineering is under way for the installation of an additional Foster Wheeler 1,000,000 lb per hr reheat steam generator designed to serve a 125,000 kw unit. When ultimately completed, the station is expected to have a capacity of more than 700,000 kw.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW

present, and future



YORK 6, N. Y.

FOSTER WHEELER

NEW 1951
CHEVROLET ADVANCE-DESIGN TRUCKS

New FEATURES! New QUALITY! New VALUE!

You'll find everything in these new 1951 Chevrolet trucks—everything that has made Chevrolet the world's most popular make *plus* new features and improvements that put them still farther ahead of the field. As a truck user, you'll welcome Chevrolet's new, better designed brakes for their increased effectiveness . . . their thrifty long life and extra safety! You'll recognize important contributions to trucking in Chevrolet's Dual-Shoe parking brake, the new Ventipanes, and Chevrolet's new cab seats . . . the very tops for riding comfort! See your Chevrolet dealer and take a good look at these 1951 Chevrolet trucks at your first opportunity. The "best in the business" are better than ever today! Chevrolet Motor Division, *General Motors Corp.*, Detroit 2, Mich.

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the 105-h.p. Loadmaster or the 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • POWER-JET CARBURETOR—for smooth, quick acceleration response • DIAPHRAGM SPRING CLUTCH—for easy-action engagement • SYNCHRO-MESH TRANSMISSIONS—for fast, smooth shifting • HYPOID REAR AXLES—for dependability and long life • NEW TORQUE-ACTION BRAKES—for light-duty models • PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES—for medium-duty models • NEW TWIN-ACTION REAR BRAKES—for heavy-duty models • NEW DUAL-SHOE PARKING BRAKE—for greater holding ability on heavy-duty models • NEW CAB SEATS—for complete riding comfort • NEW VENTIPANES—for improved cab ventilation • WIDE-BASE WHEELS—for increased tire mileage • BALL-TYPE STEERING—for easier handling • UNIT-DESIGN BODIES—for greater load protection • ADVANCE-DESIGN STYLING—for increased comfort and modern appearance.

CHEVROLET

NOW

All Three in One High-Voltage Cable

- **MOISTURE RESISTANCE**
- **OZONE RESISTANCE**
- **RESISTANCE TO HEAT AND AGING**

For the first time these three important properties, moisture resistance, ozone resistance, and resistance to heat and aging, are combined in a single high-voltage insulation. Simplex-Anhydrex XX insulation has proved itself to be far and away your most dependable assurance of low cost, trouble-free cable operation at the higher voltages. Here's why:

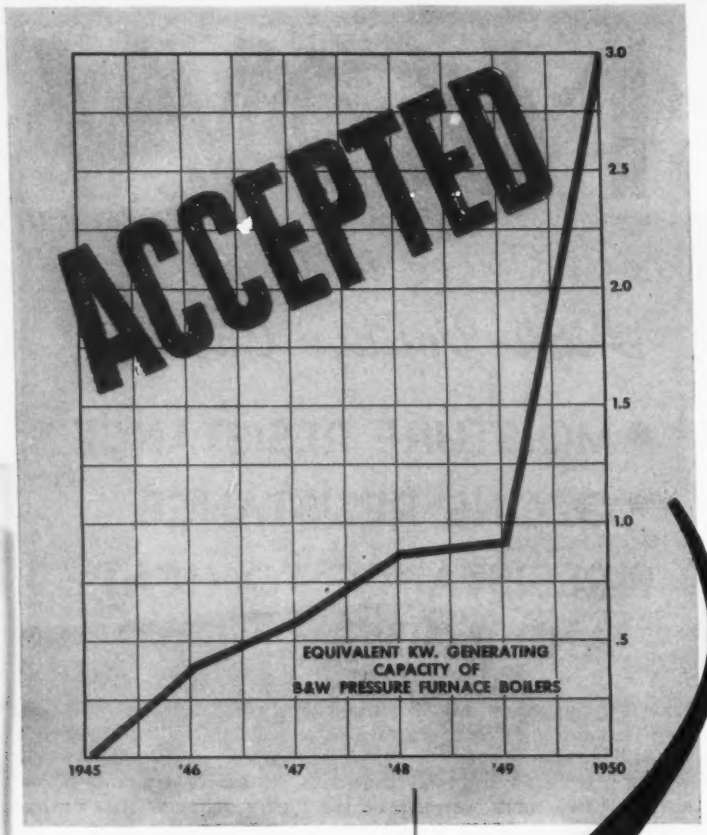
Aged for 16 weeks at 250°F. (121°C.), Simplex-Anhydrex XX retained approximately 50% of its tensile strength, nearly 68% of its elongation. More than that, its rate of deterioration after the first few weeks was very slight, indicating exceptional stability and long life. It remained rubber-like in quality and appearance and was still suitable for further use. Compare this with ordinary vegetable oil base and heat-resistant compounds which, inside of only 3 weeks, became brittle, cracked and crumbled.

Aged for 7 days at 250°F. (121°C.), Anhydrex XX was then immersed for a week in distilled water at 158°F. (70°C.). It absorbed less than 15 mg. per square inch of exposed surface.

Aged for 7 days at 250°F. (121°C.), Simplex-Anhydrex XX was bent around a mandrel and exposed to .03% ozone for 4 hours yet would not crack.

Compare these values with those of any other high-voltage insulation. You'll find a big difference whenever Simplex-ANHYDREX XX Cables are on the job; a difference that pays off in more economical, more efficient, and more reliable power transmission. If you would like more complete information and specification data on Anhydrex XX insulation, simply drop us a line at the address below.

SIMPLEX WIRE AND CABLE COMPANY
79 Sidney Street, Cambridge 39, Massachusetts



B&W puts the pre

NEW

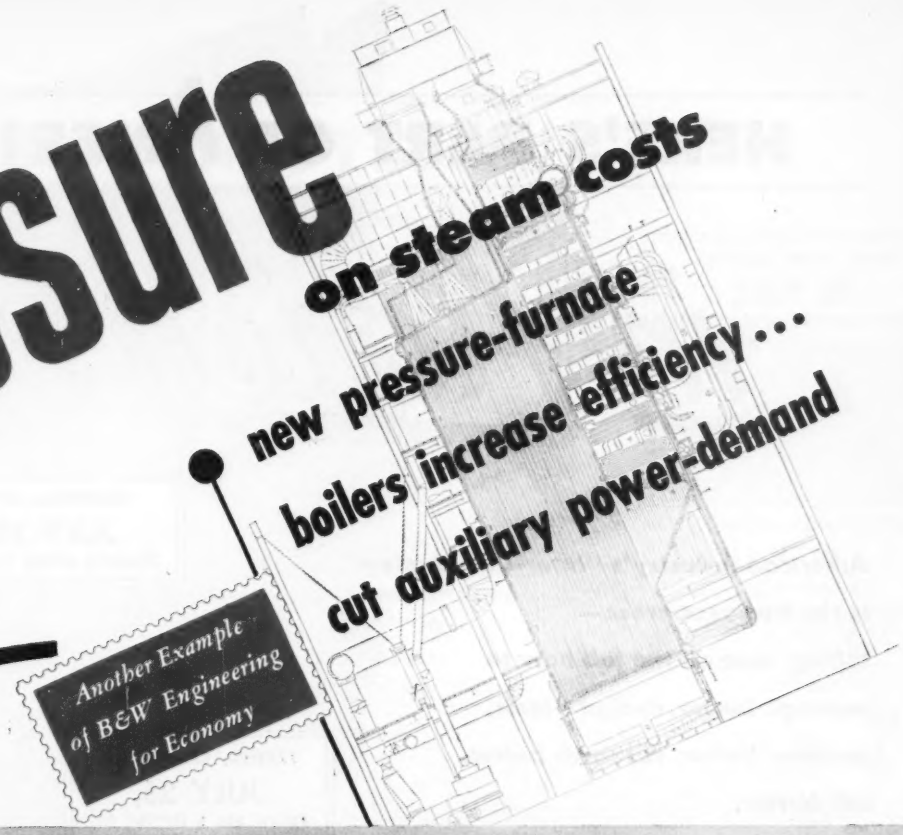
...improved principle of boiler-furnace operation pioneered by B&W

MAJOR COST SAVING ADVANTAGES

1. Eliminates ID fan—lowers demand charge.
2. Prevents air infiltration—provides higher boiler efficiency.
3. Simplifies draft control—permits quick, easy, effective adjustment to optimum combustion conditions at all loads.
4. Simplifies design—lowers initial cost of duct and stack arrangement.

ssure on steam costs

new pressure-furnace boilers increase efficiency . . . cut auxiliary power-demand



Another Example of B&W Engineering for Economy

Stacks will be shorter in 1951, as B&W Pressure-Furnace Boilers set the style in higher boiler efficiency and lower auxiliary power-demand.

Acceptance of this most recent type of furnace construction followed rapidly upon its first successful applications to Stirling, Integral-Furnace, Radiant, and Open-Pass units. Comparison of advantages in conventional vs. pressure-casing designs inevitably leads to a choice of the latter for *most* operating conditions.

As the chart shows, orders have been received for an equivalent generating capacity of about three million kw, comprising installations of Integral-Furnace and Radiant Boilers ranging from 250,000 to 1,357,000 lb. per hr. individual steam capacity. Fuels include gas, oil, and both pulverized and cyclone-fired coals.

Helping America's electric companies to keep power costs down is an 83-year tradition with B&W . . . currently evident in such pioneering developments as Cyclone-Firing, Gas-Recirculation, and Natural Circulation at pressures to 2500 psi. You'll want to learn the details of these significant features as they relate to your own company's future requirements. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

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HERE'S PART OF AMERICA'S

in Action!

American Industry's "Inter-Com System" is the business press — telling men on the job how to manage better, design better, produce better, research better, sell better.

Here is one of its greatest members in action — the "inter-com system" for the electric power industry:

In just 12 days F. W. Chapman, Superintendent of the Commission of Public Works in Greenwood, South Carolina, got nine letters from eight states and Canada, containing 21 pages of text and four blueprints — all of it expert technical opinion on the cause and solution of an engineering problem.

Mr. Chapman wrote his problem (concerning the grounding of a neutral in a delta-star bank of transformers) to Electrical World, where it appeared on July 17, in "Letters to the Editor." Readers responded, from coast to coast, as the map shows.

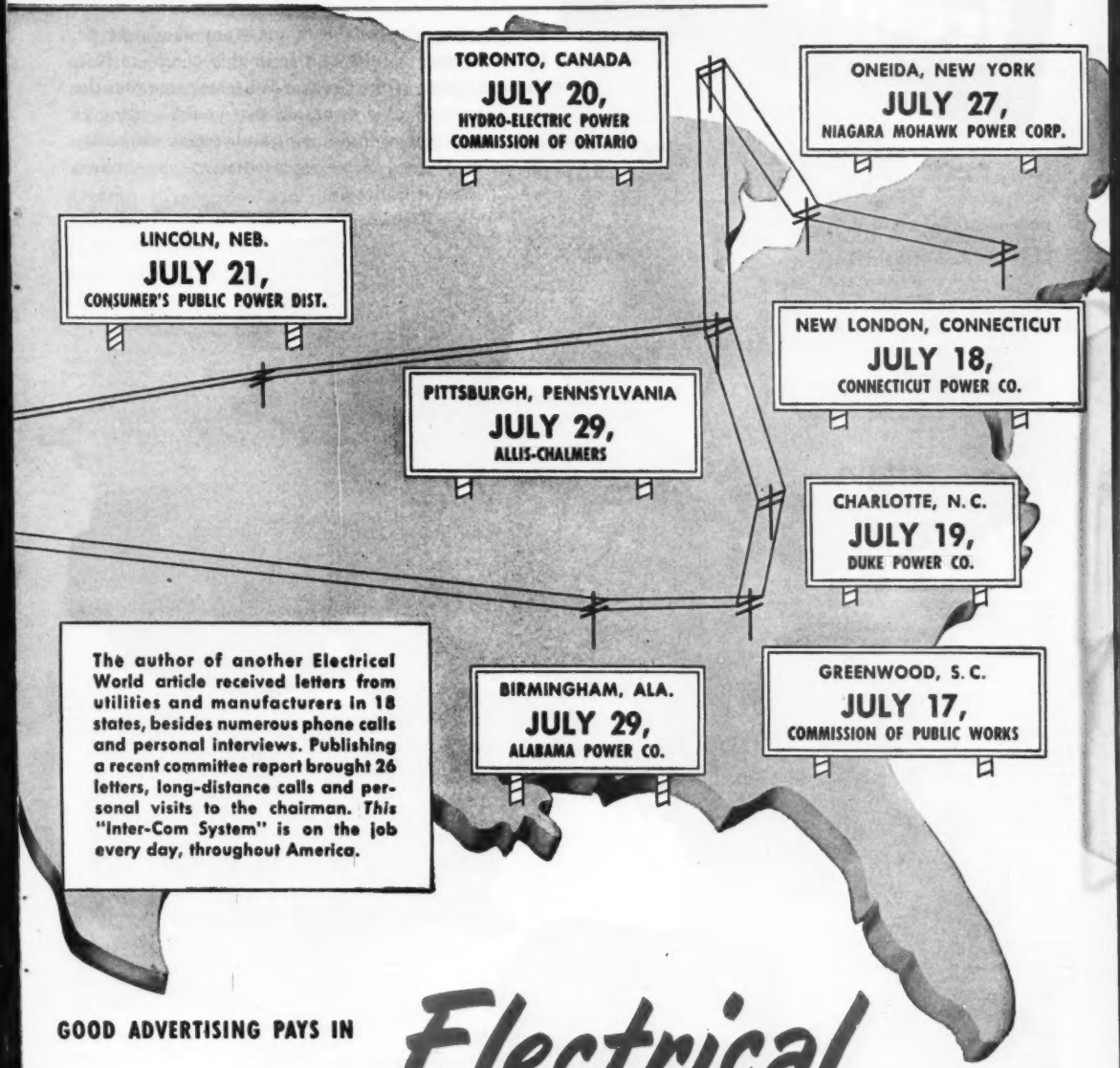
Highest industry authorities gave their opinions — a general manager, a research director, a system superintendent, etc. In what other way could you organize top thinking throughout the country — so fast?

That's the inter-com system at work, swift and effective, concentrating the industry's vast reservoir of knowledge and focusing it upon one man's problem.

Multiply that by thousands and you see Electrical World in action every week, guiding, correcting, reporting, criticizing and acclaiming — not half so much because we are wise teachers, as because we are the information clearing house — the central switchboard of this particular industry.

This active, participating interest applies itself to your advertising when you make your story useful to the man on the job. For action in the Great-Growth Industry, throughout America,

"INTER-COM SYSTEM"



The author of another Electrical World article received letters from utilities and manufacturers in 18 states, besides numerous phone calls and personal interviews. Publishing a recent committee report brought 26 letters, long-distance calls and personal visits to the chairman. *This* "Inter-Com System" is on the job every day, throughout America.

GOOD ADVERTISING PAYS IN

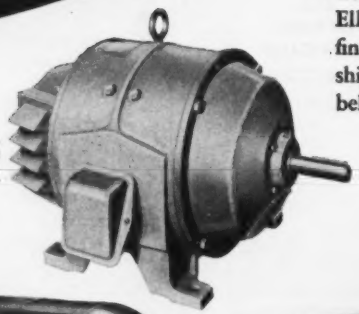
Electrical World

JOURNAL OF THE GREAT GROWTH INDUSTRY FOR 76 YEARS

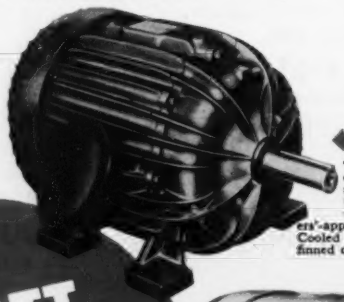
ABC • ABP

In motors from 1 hp up you're a step

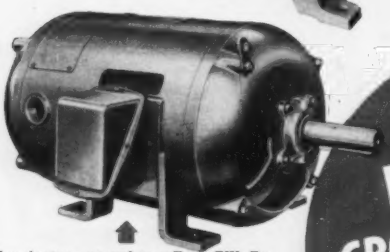
Looking for a dependable motor in any standard type, 1 hp or larger? You'll find it in this complete line, with the backing of the Crocker-Wheeler name plus the Elliott name—double assurance that you're getting as fine a motor as skilled engineering and veteran workmanship can turn out... Some representative types shown below. Write for bulletins.



DC dripproof and dripproof-protected types Form F, in ratings to 7½ hp. Form H, 10 to 200 hp.

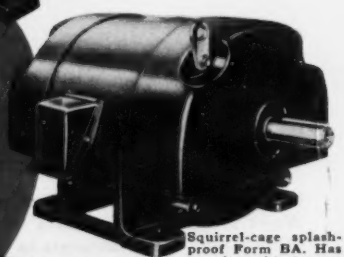


"Sealedpower" totally-enclosed fan-cooled squirrel-cage motors, 3 to 125 hp. Also explosion-proof underwriters'-approved, 20 to 125 hp. Cooled by air blown along the finned outer case.

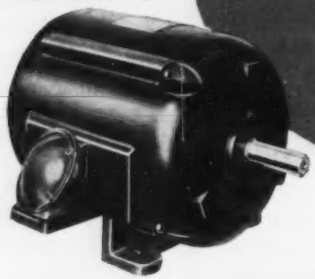


Wound-rotor protected type Form BW. For slow, smooth acceleration, high starting torque with low starting current, or variable speed. Drip-proof, splash-proof, 1 to 200 hp.

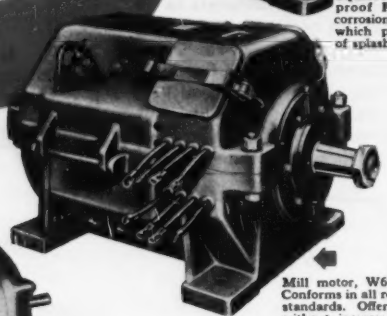
ELLIOTT
CROCKER-WHEELER
Integral
motors



Squirrel-cage splash-proof Form BA. Has corrosion-resistant covers which prevent entrance of splashing liquids.

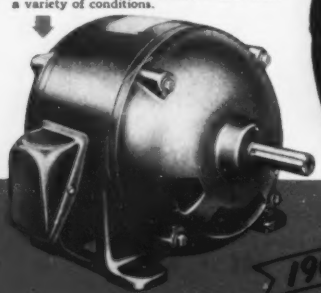


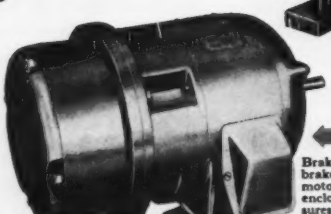
Squirrel-cage, totally-enclosed, non-ventilated Form BE. Available up to and including 3 hp at 1800 rpm, for applications requiring protection against dust, fumes, moisture.



Mill motor, W600 Series, DC. Conforms in all respects to AISE standards. Offers more power without increase in frame size.

Squirrel-cage protected type Form BA. An open dripproof motor for general purpose use. Available in wide modifications to meet a variety of conditions.





Brake motor using latest disk type brake mounted on BA dripproof motor. Also available with totally enclosed and splashproof enclosures for AC or DC applications.

HALF CENTURY OF 1901 E 1951 POWER PROGRESS

ELLIOTT

Crocker-Wheeler Division—Ampere, N. J.

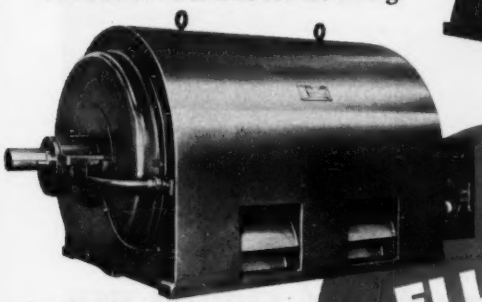
DISTRICT OFFICES IN PRINCIPAL CITIES

ahead with ELLIOTT

Looking for a really big motor—big in quality as well as capacity? These fine Elliott motors have the exceptional strength and rigidity of welded steel construction in frame and spider with a number of other notable advantages. Fabri-steel construction marks the greatest advance in large motor design and construction since the turn of the century. Some of these outstanding motors are illustrated below. Bulletins for the asking.

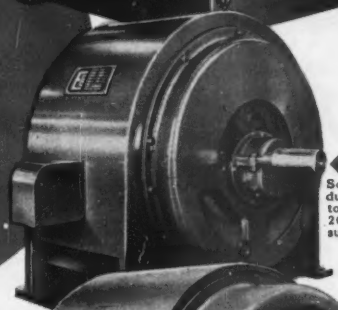
Synchronous motor for gas compressor drive. Available with solid or split rotors, open or enclosed, engine type or coupled type, rigid construction.

Totally-enclosed fan-cooled motor, cooled by heat exchanger located at top of unit. Two-pole ratings 300 to 4000 hp. For lower speeds, in sizes equivalent to 50-hp, 14-pole, to 3000-hp, four-pole.

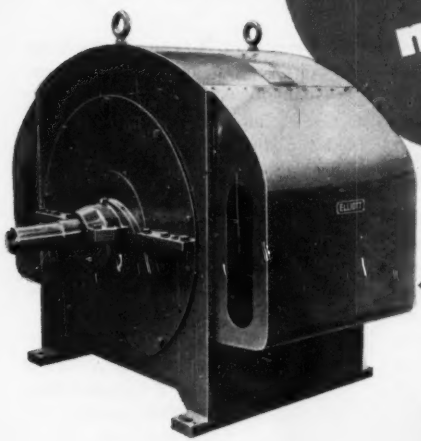


Large two-pole squirrel cage induction motor (350 hp up). A long forward step in two-pole design. Typical Elliott welded steel construction enables widest variation in type of enclosure.

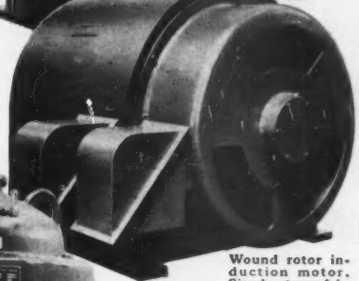
ELLIOTT large motors



Squirrel-cage induction motor, four to 14 poles, 150 to 2000 hp. All enclosure types.



Outdoor splashproof squirrel-cage induction motor especially designed for outdoor installation without protective covering. 150 hp, 14 pole to 2000 hp, four-pole, 300 hp to 1000 hp two-pole.



Wound rotor induction motor. Simple, strong fabricated construction, sleeve or anti-friction bearings. Available in all types of enclosure.

Vertical outdoor splashproof squirrel-cage induction motor. Can also be made in open drippproof or indoor splashproof with minor changes in ventilating baffles.

COMPANY

DEPT. 18

Ridgway Division—Ridgway, Pa.

DISTRICT OFFICES IN PRINCIPAL CITIES

L-906

IT'S EASY TO CARRY—weighs only 44 pounds. The case is only 19⅜" long, 10¾" high, and 9¼" deep.

IT CAN BE SET UP ANY PLACE where there's a 115-volt, a-c supply—for taxis, forestry, utilities, construction projects.

IT'S IDEAL for 2-way operation (police, fire, etc.) in small and medium-size municipalities requiring medium-range communication equipment.

For *portable or fixed* station use

. . . the RCA Carfone Station Unit "15"

THIS is the most versatile 2-way radio station ever designed for medium-range communication. It is complete with transmitter, receiver, power supply, portable antenna, handy microphone, and loud speaker—*all in a single package.*

Easy to carry and easy to set up, this portable unit can be operated wherever there is a 115-volt, a-c outlet.

For fixed station use, place the unit on the operating desk, hook-up the antenna, plug in the power cord, and you're set to go. For portable station use, simply connect the quarter-wave, whip antenna (supplied) and plug in the power cord. No extra components to carry around. No installation expense involved.

Greatly improved receiver selectivity reduces adjacent channel signals well below interference levels. A newly-designed transmitter modulation control enables you to transmit the full signal potential of the transmitter and maintain 100 per cent modulation at virtually all voice levels—*whether you shout or whisper into the microphone.*

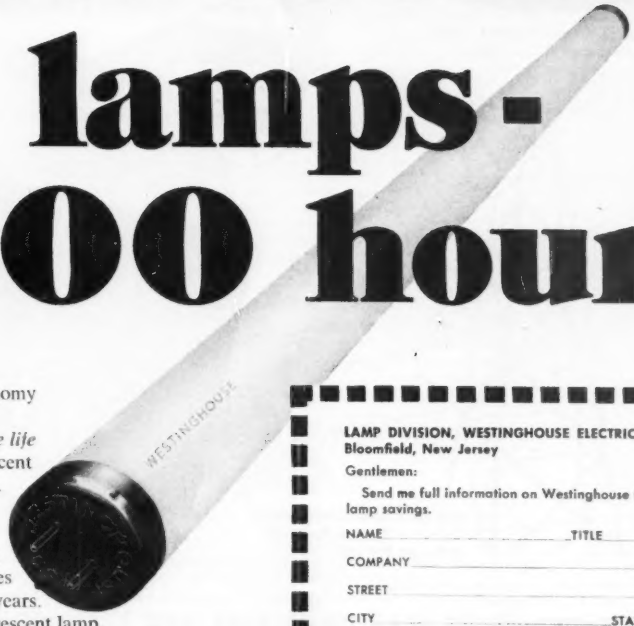
For complete information on the new RCA Carfone Station Unit "15", write Dept. N-31, RCA Engineering Products, Camden, New Jersey.

RCA

MOBILE COMMUNICATIONS SECTION
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

You can't beat this life! Life of Westinghouse fluorescent lamps - 7500 hours*



*You'll get lighting economy at no extra cost!

Yes, the *rated average life* of Westinghouse fluorescent lamps is 7500 hours. That means that in store installations the life is 2½ years; in one-shift factories and offices it's 3 years. No other fluorescent lamp, similarly priced, can top this life.

LAMP DIVISION, WESTINGHOUSE ELECTRIC CORP.
Bloomfield, New Jersey

Gentlemen:

Send me full information on Westinghouse fluorescent lamp savings.

NAME _____ TITLE _____

COMPANY _____

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EW

Demand proof OF PERFORMANCE

FIG. 1—In 1907, THOMAS was FIRST with the CAP-AND-PIN Suspension Insulator.

FIG. 2—In 1951, THOMAS is STILL the Standard of Comparison.

All insulators are not alike. To make an insulator that will do its job the trouble-free way . . . year in and year out . . . requires years of EXPERIENCE. Let's consider the Suspension Insulator as an example.

In 1907, Thomas made the first Cap-and-Pin Insulator. 10,000 units were installed that year in Central California. AFTER 44 YEARS OF CONTINUOUS SERVICE, THESE INSULATORS ARE STILL OPERATING SATISFACTORILY. Ask any other Insulator Manufacturer to support an equivalent statement.

Figure 1 shows this first Cap-and-Pin Insulator. Figure 2 is the 1951 model. Obviously, through the years, Thomas has constantly improved

SPECIFY THOMAS INSULATORS . . .

1873 THOMAS INSULATORS our 78th year RELIABILITY 1951

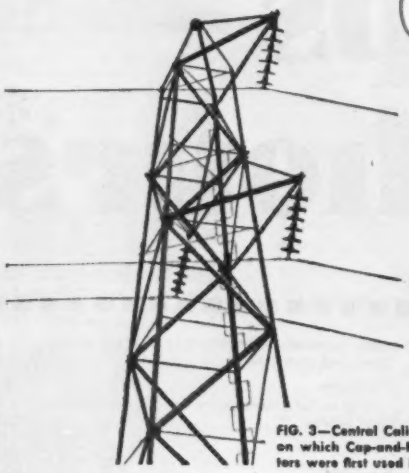


FIG. 3—Central California line on which Cap-and-Pin Insulators were first used in 1907.

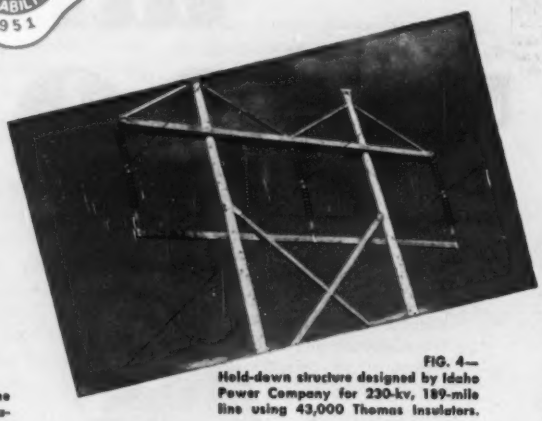


FIG. 4—Hold-down structure designed by Idaho Power Company for 230-kv, 189-mile line using 43,000 Thomas Insulators.

ENGINEERS, MANUFACTURERS AND DESIGNERS SINCE 1873

FOR SUPERIOR INSULATOR QUALITY

their design to maintain it as the Standard of Comparison.

After all is said . . . it's still quality that counts plus proper designing, precision manufacturing . . . and PROOF OF PERFORMANCE. Throughout the country, Thomas Insulators have been establishing service records since the advent of the Electrical Industry. Why gamble?

* * *

The R. Thomas and Sons Company is a manufacturer and designer of all types of porcelain insulators . . . pin-type, switch, suspension, spools, guy-strain, bushings and special high-voltage porcelain. In addition, Thomas supplies associated line hardware, clamps, fittings and so on.

. . . . THE BEST BY LINE TEST

FIG. 5—New 132-kv line of large Eastern Utility, a 35-year Customer of Thomas.

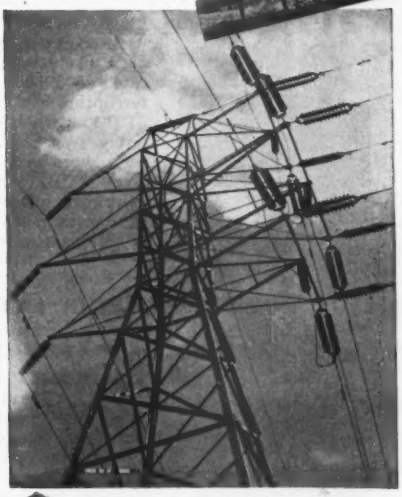


FIG. 6—New Mid-Western 132-kv Line. Naturally, Thomas Insulators were chosen for it.

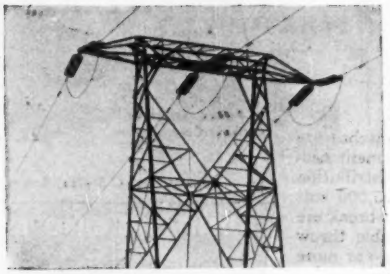


FIG. 7—Large Western 230-kv line using 50,000 Thomas Insulators installed in 1938.

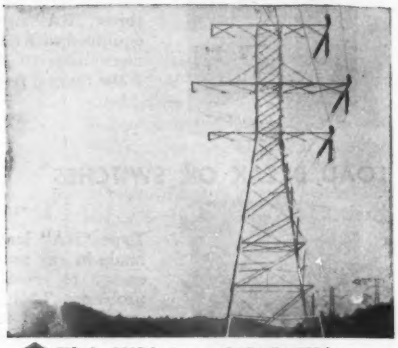


FIG. 8—2660-foot span of 69-mile, 132-kv line equipped with Thomas insulators installed in 1931.

The R. Thomas and Sons Co.

LISBON, OHIO

NEW YORK CHICAGO

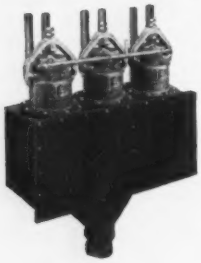
Sales Representatives: E. B. Anderson Co., *Detroit* • Paul Berry, *Oklahoma City* • Ken H. Best, *Seattle* • Butler & Land, *Dallas* • R. E. Cunningham & Son, *Los Angeles* • Electric Supply Co., *Albuquerque* • Engineer Sales Corp., *St. Petersburg* • R. F. Hamilton & Associates, *Denver* • R. H. Harper, *St. Louis* • Geo. E. Henn Company, *San Francisco* • W. J. Hugo, *Minneapolis* • Leiser & Company, *Philadelphia* • Lynn Elliott Company, *Houston* • W. C. Milburn, *Chattanooga* • John G. Pettijohn Company, *Knoxville* • Redmond Supply Co., *Phoenix* • J. F. Schaefer & Co., *Kansas City* • R. J. Sullivan & Company, *Boston* • Harvey Thomas, *Columbia, S. C.* • E. E. Terkell, *Memphis* • Triangle Electric Supply Company, *El Paso* • United Electric Supply Co., *Salt Lake City* • Joe Williams, *Little Rock*

Representatives in other principal cities

For PRIMARY CABLE SYSTEM *FLEXIBILITY*

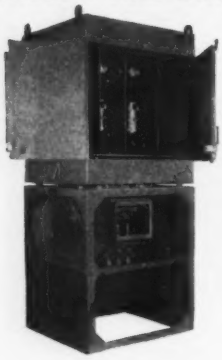
Use G & W Sectionalizing Equipment

PROTECT AND DISCONNECT SMALL LOADS



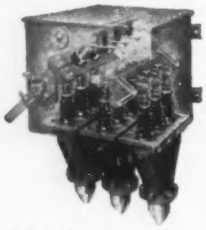
Type "FCBX" Fuse-Switch Boxes with gang-operated oil fuse cutouts mounted on cable connection compartments are rated 2500, 5000, and 8000 volts with interrupting capacities of 6000, 6000, and 3750 amperes (RMS per phase) respectively. When used within the limits of their short circuit interrupting capacity, Type "FCBX" units have wide application as primary disconnecting and protecting equipment at load distribution centers or at main sub-stations of small plants.

PROTECT AND DISCONNECT LARGER LOADS



Type "RA-SC" Fuse-Switch units with Type "RA" load break oil switches and Type "SM" power fuses are rated 7,500 and 15,000 volts with interrupting capacities of up to 30,000 amperes RMS. Continuous current carrying capacity of units and load break rating of switches is 400 amperes. A fused load can be supplied from either of two feeders through a double throw "RA" switch and the unit may be equipped with a G & W automatic transfer mechanism to assure service continuity if the normal feeder fails.

LOAD BREAK OIL SWITCHES



Type "RA" load break oil switches are made in any switching arrangement necessary to meet individual distribution problems. 7,500, 15,000, and 23,000 volt units with full 400 ampere load break are widely used in single and double throw units or in special units with two or more sets of links.

G & W engineers or engineering representatives will be glad to help you select the proper G & W equipment for your problem whether it requires a single unit or a complete primary distribution system.

Write for your copy of G & W Bulletin H49, a discussion of Primary Cable System Flexibility.

Use G & W Cable Accessories for
TERMINATING
FUSING—SWITCHING
SPLICING—CONNECTING

POTHEADS

Trouble-Free Cable Terminations

Capnut Style Disconnecting Straight Through Type "ST-SODERTITE"

Write for Bulletin AB51

OIL FUSE CUTOUTS

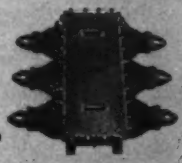
Single or Gang Operated Fuse-Switch Units

Write for Bulletin CA50

CABLE BOXES

Air or Oil Filled

Fuses, Links or Direct Connection



Many Sizes, Styles, Ratings

UNIT SPLICING KITS

Packaged Materials for Properly Designed Joints for all Types of Cables

Write for Bulletin J50

G&W ELECTRIC SPECIALTY COMPANY

7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.

Representatives in principal cities. In Canada: Powerlite Devices, Ltd., Toronto

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 3 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

CERTAINTY IN CIRCUIT TESTING WITH DIRECT INDICATING, TRUE OHMMETER

Midget Megger® Makes Many Friends

From a chief electrician of a New England fishery . . . from the Mechanical Department of a railroad . . . from users in many different industries . . . we receive letters of enthusiasm for the Midget "Megger" Circuit Testing Ohmmeter. Reports show these instruments last several decades and one user claims, "It has paid for itself 25 times or more."

This little instrument is not merely a voltmeter calibrated in ohms; it's a true ohmmeter, using any make of flat type, 3-cell flashlight battery, but operating independently of the exact battery voltage.

Push-button spring terminals for quick connections. Your choice of push-button battery switch on instrument or testing spike. Ohm scales available for ranges from .1 ohm to 200,000 ohms. Each scale has two ranges.

An "A-1" Trouble Shooter

For testing coils, resistors, contacts, windings, circuits, relays, etc., and even insulation resistance up to 50 and 200,000 ohms.

New Bulletin mailed on request. Please ask for 1495-W.

NOW, A MEGGER® THAT OPERATES *TWO WAYS*

1. By hand

2. By Plug-in Rectifier

Here is the instrument that gives you the greatest facility of insulation resistance testing . . . a regular hand-crank Megger instrument with a separate plug-in rectifier. Use the hand-crank, constant voltage generator for working from place to place around the plant. Use the plug-in rectifier for the repetitive "bench" work type of tests . . . also for the long, time-resistance tests. Rectifier works on any 115 v. 60-cycle outlet. Hand-crank generator is automatically disconnected when you hook up the rectifier.

Two important accessory features can be incorporated in the Dual-Operated set by means of a Selector Switch: (1) an Ohm Scale from 0 to 10,000 to augment the regular megohm scale and (2) a Discharge Switch to dissipate D-C charge immediately preceding or following a test.

If you need a Megger tester only for repetitive, production acceptance tests, or for time-resistance testing, we furnish the Rectifier-Operated Meg type Megger Insulation Tester with built-in transformer and rectifier. No hand-crank; just plug into 115 v. 60 cycles.

For a detailed description, write for Bulletin 21-46-W.

BIDDLE IMPULSE CABLE FAULT LOCATOR WINS APPROVAL IN A VARIETY OF INDUSTRIES

A large automobile manufacturing plant, several major power and light companies, a traction company, a well-known oil company, have recently bought Biddle Impulse Cable Fault Locators and D-C Proof Testers. The

broad diversity indicates, in a measure, the wide usefulness and economic advantages of this instrument. A mobile unit that recently toured the country brought much acclaim for the equipment wherever it was demonstrated.

Your correspondence is invited . . . For a detailed description, ask for Bulletin 65-W.

We are constantly publishing new technical bulletins on Biddle instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.

No. 2 — regarding the

★ *The Hi-Voltage Type A-W Switch is for line sectionalizing and substation work up to 46 kv.*

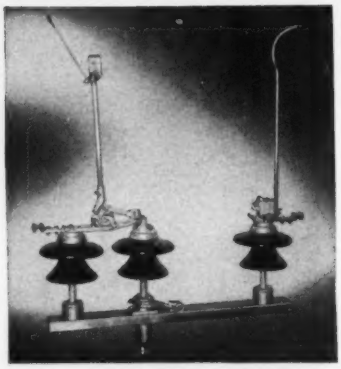
It's just one of many Hi-Voltage designs that assure the utmost in operating dependability. On the opposite page are shown some of the outstanding features that make the Type A-W the leader in its voltage rating.

Sleet, ice, years of standing idle have little effect on the operation of a Hi-Voltage switch. Certain operation is assured by the straight push-pull, close-open action of the switch arm. After clearing the contact housing, the arm is swung completely open by the powerful and precision-built operating mechanism.

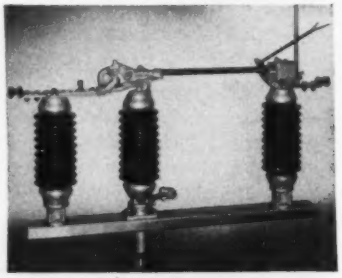
And the Type A-W reduces switch installation cost from 20 to 40%, because the mechanism is completely pre-machined and pre-fitted at the factory. All parts are positively identified . . . keyed to easy-to-follow installation data. Field cutting and drilling are eliminated.

Specify Hi-Voltage and gain the advantages of lower installation costs, more accurate installation and certain operation.

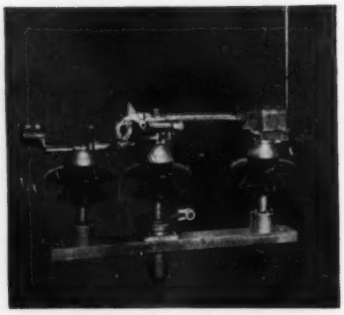
Future advertisements in this series will discuss the merits of other types of Hi-Voltage Switches. In the meantime, let your Joslyn Representative give you the whole story.



Open position of the conventional Type A-W air-break switch.



Station post insulators may be used for mounting the Type A-W.

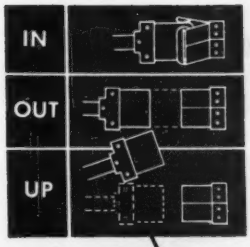


For heavy continuous duty, the Type A-W may be obtained in this 1200-ampere design.

HI-VOLTAGE

type A-W air-break switch

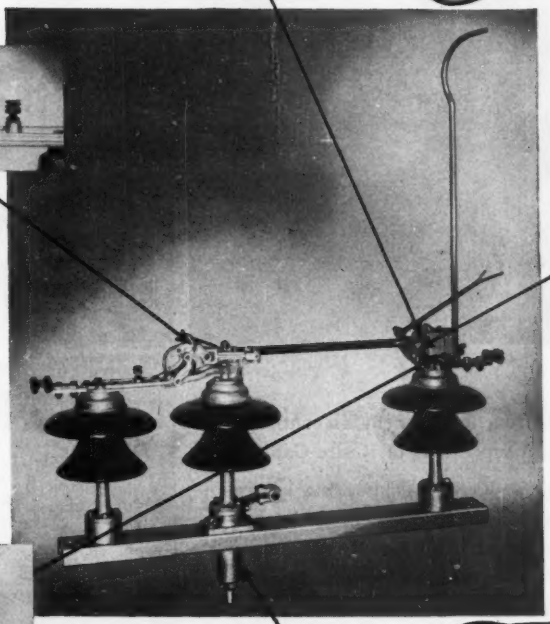
IN-OUT SWITCH ACTION . . . Straight-line motion of the switch-arm provides positive opening and closing of the switch.

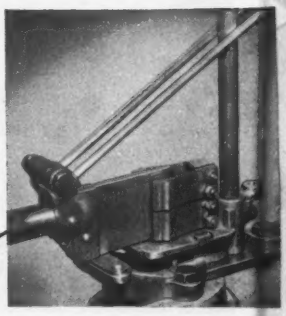


Hi-Voltage SWITCHES ARE AVAILABLE

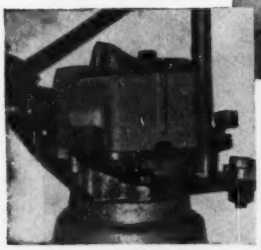
from 200 to 3000 Amperes, 7500 to 161,000 Volts for upright, underhung or vertical mounting.

OPERATING MECHANISM . . . A direct mechanical linkage. Uses no cams or rollers to deliver smooth powerful action. There is nothing to stick, bind or adjust.

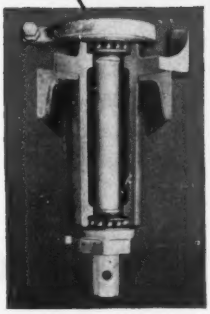




SILVER-NICKEL CONTACTS combine low resistance with low friction. Stainless steel springs maintain maximum conductivity.



CONTACT HOUSING protects contacts against sleet, dirt and arcing. Also, it acts as an ice breaker.



MAIN BEARING carrying rotating insulator is a forged steel spindle mounted in monel ball bearings and stainless steel races. Never requires lubrication.

ALSO AVAILABLE!

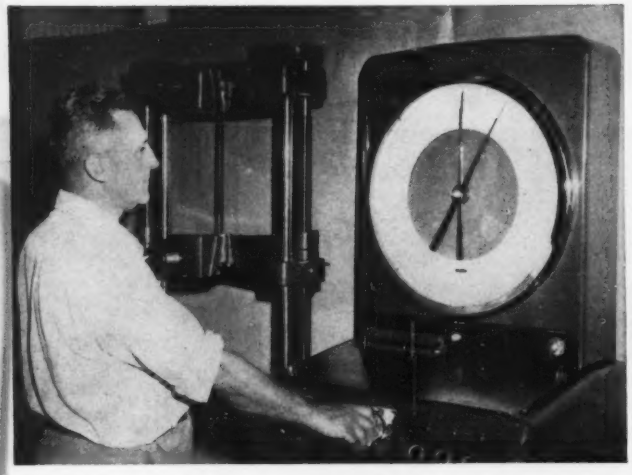
- Grounding Switches
- Manual and Automatic Control Mechanisms
- Mechanical Interlocks
- Hi-Voltage Fuses
- Cross-arms and Mounting Frames
- And all customary accessories

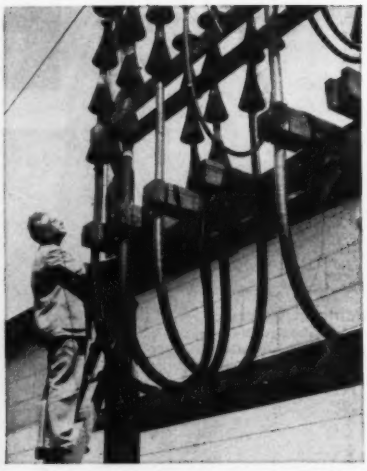
EQUIPMENT COMPANY

4000 EAST 116th STREET • CLEVELAND 5, OHIO

Fine Engineering

protects the long life inherent in Kerite Cable





Sound, resourceful engineering development is a contributing factor to the technical superiority of Kerite Cable.

Never-ending research in Kerite's engineering laboratories produces new, better ways to protect cable; new types of cable and new ways to make use of time proven Kerite insulation. Fine engineering, conscientious workmanship, and proper handling combine to protect the long life that is inherent in all Kerite insulated cables.

Kerite engineers will be glad to help you with your cable problems, whatever they may be. THE KERITE COMPANY, 30 Church Street, New York 7, N. Y. Offices also at 122 S. Michigan Avenue, Chicago; 582 Market Street, San Francisco; 714 W. Olympic Blvd., Los Angeles.

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KERITE CABLE

Kerite Insulation—Your Cable's Best Life Insurance

All-Industry Statistics

Each great industry needs a focal point for the assembly of vital material relating to the health and growth of the various elements. The only source of such consolidated information on the electrical industry is Electrical World. Providing such an essential service to the industry requires the utmost in completeness and impartial treatment of all the facts.

In this 47th Annual Statistical Issue of Electrical World, we have bent all of our efforts toward compiling such a picture of the various segments of the electrical industry. In those cases where we have not furnished pertinent data, the information was not available in actual or estimated form. We hope that this will represent only a feeble beginning of a much more complete analysis of industry statistics in the years ahead.

In this issue you will find all important historical statistics; a revised estimate of industry growth for the next five years; budgets for 1951 covering federal projects, municipals, electric co-ops, public utility districts, and power companies; a list of new generating units planned for the next three years and thereafter; and other sections on labor, finance, maintenance, manufacturing, etc. Data on electric co-ops is incomplete due to the low percentage of returns of questionnaires. We have almost a 100% sample of the remainder of the industry.

Looking back on 1950, we find a year of records. These maximums include a 38-billion-kwhr gain in output, a 7-billion kwhr-output week and $3-billion capital expenditures for all agencies. The capacity increase is estimated at 6.1 million kw for 1950 compared with 6.5 million kw for 1949. Customers added amounted to about 2.3 million, equal to the records established in 1947 and 1948.

As the outlook is gauged for 1951 and thereafter, the mid-century year of 1950 may stand as the record growth year for a long time. Although budgets call for expenditures of $3.2 billion and capacity additions of 7.7 million kw in 1951, lack of material may cut deeply into these plans.

We have assumed that the political atmosphere and the military program will remain similar to that of today for the next five years. With this in view, continued expansion of industrial facilities will receive priority next to military items. Whether power system equipment is installed in 1951 or 1952 becomes academic. Eventually all the facilities now planned will be installed and new items will be added from time to time. For these reasons it is believed that by 1955 the industry will have achieved the growth previously predicted for a peacetime era.

In recording these events of the future, we will strive at all times to adhere to our pledge of giving all-industry statistics.

Reflective Radiant Home Heating

Nearest approach to true radiant heating—and cooling—in the home appears to be in a house built on the ideas of Dr Clarence A. Mills, professor of experimental medicine at the University of Cincinnati.

Perched on a hill in the center of the city, with more than usual exposure to wind and weather, the house is not insulated according to the conventional definition—no cellular material in the walls and ceiling, no weather-stripping, no double windows, no special provision for prevention of heat flow by convection or conduction into or out of the structure. But the house is insulated against loss of radiant heat by coverage of inside wall, ceiling and floor surfaces with heat-reflecting aluminum foil. The structure is designed to be a reflective box for inside radiant heat. When heating is needed, it is provided by electrical elements in a radiator trough around the ceiling edges of the rooms. When cooling is needed the trough is refrigerated.

Outside air is drawn into and circulated through the house under slight pressure to provide outward seepage. This air is cleaned only, not heated in winter or cooled in summer. No concern is given to air temperature at any time.

Preliminary test results seem to indicate that people can live and move in the environment provided by this house without discomfort from heat or cold. Comprehensive records of electricity utilization and of other pertinent data are being made this winter. Data obtained during September and October give promise of considerably lower energy consumption than is possible with ordinary resistance-type electric heating.

In effect, the heating in this house is turned on and off like electric lighting. Just as you are in the dark when the light is turned off, so in this house you are in the cold when the heat is turned off. The structure has little or no heat storage capability available for carry-over through a service outage or through a peak period when it might be desirable to reduce or eliminate the heating demand. After their recent experience with what high winds can do to poles and wires, a lot of people in the eastern states would undoubtedly consider this lack of heat storage a serious disadvantage.

A Real Not Imaginary Power Shortage

For those who rant without foundation about power shortages in the United States, here is an illustration of the real thing. The following is quoted from "The Electrician," a magazine published in London, in an editorial "British Electricity":

"References which have been made by numerous speakers to this subject in the past few weeks render it advisable to summarize the salient features outlined in the BEA (British Electricity Authority) second Report. In the year ended March 31, 1950, load shedding was necessary on 124 occasions. By Grid control areas, Central and South Scotland had load shedding on 62 days, North East England on 89 days, the North West on 68 days, Mid-East England on 72 days, Birmingham area on 36 days, the South East on 41 and the South West on 38 days. It will be seen that the North East suffered most severely. The majority of cuts occurred in December, with November and September ranking equally second, and the best month was July. The maximum reduction called for in any Grid control area was 25% and the maximum load shed at any one time was of the order of 1,149 MW, equivalent to 10.6% of the load carried at that time. The Report expresses the hope that load-shedding will be comparatively infrequent by 1954-55 and very exceptional in the three following winters."

Production

"We must plan and work together to increase the total productive strength of our economy by at least 25% within the next five years." Such is President Truman's statement in his Economic Report to the Congress.

To achieve this gain in production, the economic advisors suggest three opportunities. First, an increase of two hours in the work week, giving a gain of 5%. Second, 2 million more persons in the labor force, which adds 3% to production. Third, an increase in productivity. The economic advisors admit, however, that the first two factors, along with the conversion difficulties, would tend to have an unfavorable impact on the third.

There is certainly no government edict that can materially affect the productivity of our industries. Employee training and morale along with improved machinery and techniques are the only doors open.

The know-how and equipment that can be provided by the electrical industry are the key to this important contribution to the mobilization program. As a secondary benefit, this is the best way to prevent further regimentation.

Mr President, It Is On Order

In his Economic Report to the Congress President Truman says, "In the face of this situation, we should plan to increase our generating capacity by well over 20 million kw during the next three years. The major share of this expansion must come from private utility enterprises. The large public hydroelectric projects take more time, but I am recommending the development of additional public power capacity . . . to contribute needed additions to the power supply as quickly as they can be built."

Mr President, in view of your campaign statements to the contrary, we doubt that you realize what you have said. But we submit that you are quite correct in your assertion. We should also like you to know that those 20 million kw are on order and will be installed in ample time to satisfy America's needs.

The Electrical Week

IN WASHINGTON—Most of industry will be operating largely under orders from Washington after July 1. That's the date set by the Defense Production Administration for the start of a new Controlled Materials Plan (p 109) . . . Some 25 electric utilities have been granted exemptions from various provisions of NPA's order restricting use of copper (p 109) . . . A motion by the federal defendants to dismiss the suit 10 Missouri and Arkansas power companies have brought to bar REA loans for generating and transmission facilities in Missouri has been overruled in U. S. District Court in Washington (p 111).

ELSEWHERE—Four federal agencies and the Edison Electric Institute compile industry statistics (p 106) . . . The steadily increasing need for well trained men in engineering was emphasized by Titus G. LeClair, president, American Institute of Electrical Engineers, in the opening address of the institute's winter general meeting at New York (p 108) . . . Not in seven years has the electric utility accident record been as good as 1950 promises to be when the statistics are fully compiled, it was reported to the EEI Accident Prevention Committee at Baltimore (p 110) . . . Dr Donald P. Campbell, a professor at MIT, was honored as the "outstanding young electrical engineer of 1950" by the Eta Kappa Nu Association Jan. 22 at New York (p 110) . . . The necessity for conservation of materials and manpower was stressed at the annual conference of Doble Engineering Co clients at Boston (p 111) . . . And a freak accident at the Kearny (N. J.) Station of Public Service Electric & Gas Co recently resulted in sufficient damage to three of the station's 40,000-kw generators to require their rewinding (p 113).

• • •

The Water Resources Policy Commission is meeting this week in Washington to draw up basic water legislation to be recommended to President Truman. Because of the work involved it is not likely that the President can have a model bill ready for this session of Congress.

D. L. Marlett, acting Defense Power Administrator until C. B. McManus took office Jan. 4, has returned to his post as assistant administrator of Bonneville Power Administration. He was honored at a dinner in Washington by Defense Power officials and was praised for his Defense Power work by McManus.

At times even unions can find some good in the Taft-Hartley Act. In a recent case being fought in the U. S. Supreme Court involving the constitutionality of the Wisconsin utility anti-strike law, several unions contended that it was superseded and nullified by the T-H Act. The reason: The state law imposes compulsory arbitration; the national law doesn't.

November sales of electrical goods wholesalers were down 5% from October, but up 35% over November, 1949. The first 11 months of 1950 were 26% ahead of the same period in the previous year, according to estimates by the Department of Commerce's Office of Business Economics.

Precipitation on the watersheds of Central Maine Power Co in November has been equalled but once in the past half-century.

Recreation Dept—Turn to the weekly output chart in this issue. Take a pencil and trace the 1951 curve as you foresee it. Check weekly to see how right or wrong you are.

Television now reaches 10 million homes and has an audience of 40 million persons, estimates Frank M. Folsom, president of Radio Corporation of America.

Notes From The News

Appalachian Electric Power Co is making it easy for its customers to pay their bills. The utility has installed a night deposit box in Bluefield, Va., so that payments may be made at any hour of the day or night . . . Power blackouts are plaguing British officials. As a local electricity board executive in Bagshot was explaining why power cuts had to be made the lights went out. He continued to talk by candlelight . . . New England Mutual Life Insurance Co plans to install a generator in its Boston office to operate on a standby basis if local power facilities are bombed out . . . After 50 years of living with a guilty conscience a man turned over two $20 bills to the Alameda (Calif.) Public Utilities Board. He confessed that in 1901 he had by-passed his meter . . . Plans are under way for a housing project to accommodate workers on Ontario Hydro Commission's new power project at Niagara Falls, Ont. The homes will be built in groups of 10 to 15 in municipalities surrounding the city rather than in one large development. Several thousand men are expected to be employed.

GETTING OUT the 47th Statistical Issue of Electrical World meant a lot of conferences, a lot of discussion, and finally a lot of work on the part of many members of the staff. At this conference were, seated, left to right, Miss Josephine Mulloy, typist and secretary; Associate Editor Frank R. Innes; Editor-in-Chief Fischer S. Black; Miss Jean Carroll, production supervisor; and Managing Editor Daniel T. Braymer. Standing are Douglas Greenwald, McGraw-Hill Department of Economics; Assistant Editor Francis J. Kovalcik; Art Consultant Dallas Mallard; and Art Editor Earl Carver. **For results see page 115**

Statistics Show Past, Indicate Future

4 Federal Agencies and Edison Electric Institute Compile Data on the Industry; Electrical World's Statistical Issue a Pioneer

Statistics show where the industry has been; interpretation of statistics shows where the industry is going. This has been the belief of editors of Electrical World for years back.

Electrical World was for many years the only source of industry statistics. In its earlier years it employed a large staff who compiled weekly, monthly, and annual statistics which today are still recognized as being the only record of those formative years.

This is the 47th Annual Statistical Issue of this magazine—EW was the first magazine to publish such an issue. As in the past this is the first compilation of the previous year's statistics. Of course, some of the figures are estimated, but they are close enough for working purposes. The exact figures will not be available from other sources for several months.

The statistical work that EW formerly carried on is now taken care of by a number of government agencies and the Edison Electric Institute. All cooperate throughout the year in supplying information for the many statistical features EW carries. At the year's end they interrupt their own work to supply EW with the latest figures available so that statistics in this issue are as accurate as possible.

SEC STATISTICS are supervised by Vito Natrella, left, and Ralph H. Krappy, right, Division of Trading and Exchanges; and Amerst E. Huson, center, Division of Public Utilities

EDISON ELECTRIC INSTITUTE's Thomas J. Malone, left, and Statistician George Payne study load figures submitted by utilities before estimating the monthly peak load for EW

REA's STATISTICS are compiled under the supervision of Everett C. Weitzell, left, program analyst, and David M. Adison, head of the administration's Statistical Services Section

BUREAU OF LABOR STATISTICS are given to Joseph G. Gambatese, right, who covers labor news in Washington for Electrical World, by Ewen Clague, commissioner of the bureau

There are four major federal government sources of industry statistics. Of these the Federal Power Commission is the most important. FPC's statistics section of its Division of Finance and Statistics has three major reports units:

The Rate Reports Unit maintains files of rate schedules and publishes the "National Electric Rate Book" and the annual "Typical Electric Bills."

The Financial Reports Unit prepares the yearly "Statistics of Electric Utilities in the United States" and a companion volume covering natural gas utilities.

The Power Reports Unit gathers information on electric generating capacity and production covering all plants of 100 kw or more capacity, including fuel consumption figures. These reports are published regularly as parts of the loose-leaf "Electric Power Statistics."

A fourth statistical unit in the section prepares general surveys such as the "Directory of Electric and Gas Utilities in the United States" and "Industrial Electric Power in the United States."

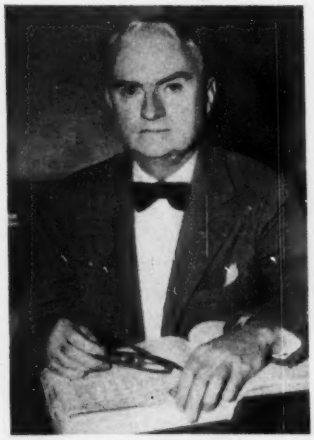
The Rural Electrification Administration keeps track of operations of borrowers, numbering 1,007 systems, and of REA itself. Monthly bulletins show operational figures by states. An annual statistical report gives figures for each system for the calendar year. REA also supplies reports such as the number of electrified farms.

Financial statistics are the field of the Securities and Exchange Commission. Its Division of Public Utilities compiles figures on operations, financing, and offerings by registered holding companies and their subsidiaries. Many of these statistics are published in the agency's annual report. There is a special report on registered public utility holding company systems as of June 30 published each year.

Electric utilities also are included in the extensive statistics prepared by SEC's Division of Trading and Exchanges. These include compilations on the cost of flotation of registered securities issued quarterly and data on all securities, quarterly estimates of plant and equipment expenditures, and quarterly releases on new security offerings and working capital of corporations. This division also publishes a directory of registrants and subsidiaries.

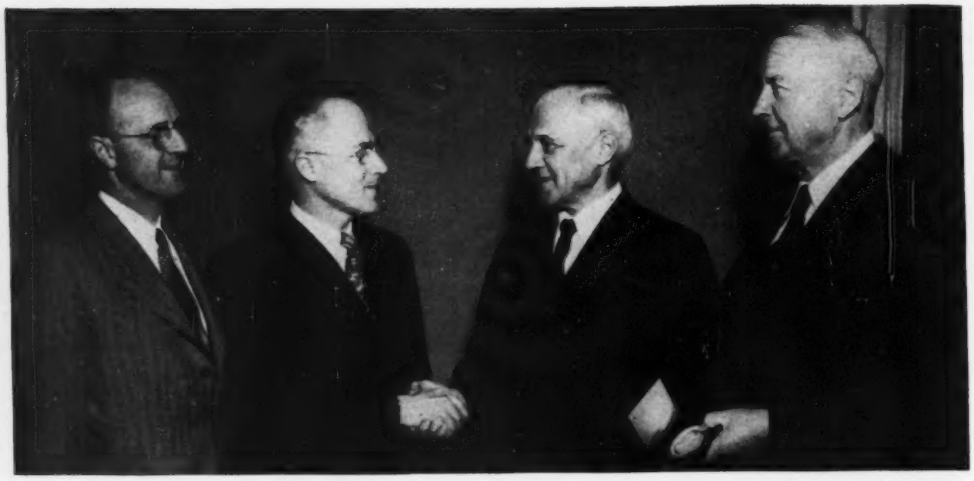
The Bureau of Labor Statistics of the Department of Labor supplies data, not all of which isolate those of the electric power industry. Subjects covered include strikes, industrial relations, productivity, monthly employment and payrolls, hours and earnings, and various price studies.

Edison Electric Institute is the statistical organization of the investor-owned electric companies. Because of its location in New York it is frequently called on by press associations, newspapers, magazines, trade associations, and engineering and financial firms to supply industry statistics. Its weekly output report is recognized nationally as one of the best indices of business activity. Its annual "Statistical Bulletin" is the industry's "bible."



EMMETT G. CRAIG, chief, FPC's Division of Finance and Statistics, bosses the industry's leading source of statistics

PHONING FIGURES for EW's weekly output story and chart is chore of Miss Marion Blake, Edison Electric Institute



HOOVER MEDAL presentation group consists of Dr C. G. Suits, left, who gave the career citation; T. G. LeClair, who presented the medal; Dr Karl T. Compton, who received it; and Dr Scott Turner, chairman of the Hoover Medal Board of Award

Growing Need for Well-Trained Men in Engineering Cited at AIEE Parley

The steadily increasing need for well trained men in engineering was emphasized by Titus G. LeClair, president, American Institute of Electrical Engineers, in the opening address of the institute's winter general meeting. Close to 3,000 engineers attended the meeting in New York.

Three general sessions were devoted for the most part to the presentation of medals and other awards to outstanding engineers. The many technical sessions of the five-day meeting will be covered by the engineering staff of Electrical World in next week's issue.

LeClair, who is chief electrical engineer of Commonwealth Edison Co, Chicago, in his address deplored the rapid decrease in enrollment of engineering colleges. He observed that the 1940-50 engineering graduates were absorbed readily into industry without lowering salary standards. There is no reason for not believing that industry "will continue to require a large number of engineers in the future for continuing technical progress."

Urging his audience to be emissaries of the profession in presenting engineering as a "remarkable opportunity," he asked them to encourage young men to enter the profession.

The four most important awards made were these:

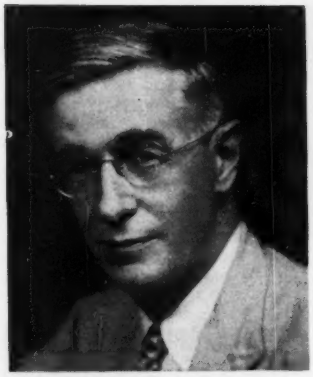
Hoover Medal to Dr Karl T. Compton, chairman of the corporation of Massachusetts Institute of Technology, for "distinguished public service."

John Fritz Medal to Dr Vannevar Bush, president of the Carnegie Institution of Washington, D. C., for "outstanding scientific contributions to his country and to his fellow men."

Edison Medal to Otto B. Blackwell, retired assistant vice president of the American Telephone & Telegraph Co, for "his pioneer contributions to the art of telephone transmission."

Alfred Noble Prize to Ralph J. Kochenburger, assistant professor of electrical engineering at the University of Connecticut, for his paper on "Servo-Mechanisms."

ALFRED NOBLE PRIZE was presented to Ralph J. Kochenburger, University of Connecticut, by E. E. Howard, past president, American Society of Civil Engineers



JOHN FRITZ MEDAL was presented in abstentia to Dr Vannevar Bush

Compton in his response followed the theme of President LeClair on the need for trained engineers. However, he slanted his address to the government's need for able personnel in these trying times. He pointed out the difficulties the federal government has to find qualified personnel to take important positions of leadership.

"It has been notable that the same names are discussed over and over again for various positions. Their number is not large. They are generally old enough to have achieved experience and recognition and still young enough to stand the exacting demands of a national emergency program. Undoubtedly there are others who have the inherently desirable qualifications. Their discovery is the major problem."

Dr Bush was unable to be present to accept the John Fritz Medal. It was accepted on his behalf by President LeClair, who also read the speech of acceptance in which Bush said,

"The need of the armed forces for engineers is important right now. But if they are called up in too great numbers, we are in danger of wrecking the industry we are trying to put back on a war production basis. We have not tested our capabilities for discipline, self sacrifice, and denial in a period which lacks the unifying stimulus of open warfare. It may lead us to absurd extremes, to unnecessary sacrifice of our liberties, to improvidence and inflation. On the other hand it may refine our democratic system and render it more stable as we unite under stress."

DPA Sets July 1 as Starting Date for New Controlled Materials Plan

Most of industry will be operating largely under orders from Washington after July 1. That's the date set by the Defense Production Administration for the start of a new Controlled Materials Plan.

Initial orders, reporting forms for industry, and informational material now are being prepared. Business probably will get formal notice of the part it is expected to play under CMP within the next month.

The new program will resemble the World War II CMP closely. It will be based on complete government regulation of the use of steel, copper, and aluminum. There will be allocation programs to secure these and other scarce materials for military equipment and such essential civilian activities as electric gas, and other utilities; shipping and other forms of transportation; hospitals; and schools.

Control to be Limited

But, for a while at least, considerably less than 100% of the economy will be directly controlled by CMP. The controlled production—that which supplies military and essential civilian requirements—will be taking much less out of the economy than the original CMP at its height in 1945.

One measure of the difference is the demand for metals for military requirements alone. These demands will take less than half the available supply of aluminum and copper and less than a quarter of the carbon steel this year. On the other hand, the military took all our aluminum and most of the copper for long periods during the war.

Nonessential Uses Banned

Allocations for other essential uses will take more metal, but, theoretically, CMP won't touch the unallocated portions. But the fact is DPA has no intention of permitting a wild scramble for production not used for essential programs. The mobilizers already have taken steps. As military buying started squeezing the supply of materials like copper and aluminum, Washington banned the use of those metals for gadgets, building materials, and decorative trim. Bans on construction, like the freeze on commercial building, saved critical materials.

Right from the start CMP will bring scheduling of all defense and other essential production. Makers of such materials and equipment will tell the government how much copper, steel, and aluminum they need and when they'll need it. This list will be screened by DPA, which will match them against the available supplies of the three metals. It will grant allocations, not to manufacturers themselves, but to government claimant agencies.

The claimant agency will split metals allocations among its prime contractors.

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NPA Grants Exemptions to Utilities on Copper Use

Some 25 electric utilities have been granted exemptions from various provisions of the National Production Authority's order restricting use of copper.

Requests for exemptions filed by the Department of Interior's Defense Power Administration are being approved by NPA "immediately," a spokesman confirmed. Meanwhile Defense Power and NPA are working out electric utility allotments of copper, aluminum, and steel for the second quarter. These will be assigned to Defense Power by NPA, and the Interior agency will supervise distribution within the industry.

Exemptions granted to electric utilities by NPA have covered a wide variety of copper products, largely for use in adding new capacity.

Most publicized of the utility exemptions, however, was for connecting new homes. Long Island Lighting Co, faced with a growing backlog of new homes to be connected, has been granted permission to use substantially greater amounts of copper than 85% of its monthly average use in the base period of the first six months of 1950. After the exemption had actually been granted in Washington, New York newspapers carried stories indicating that electric service installations on Long Island were being curtailed by NPA.

Utility 1950 Accident Record 7-Year Best, EEI Committee Told

The electric utility accident record for 1950 promises to be the best in seven years when the statistics are fully compiled. Figures for half the industry reported to the Edison Electric Institute Accident Prevention Committee in Baltimore by H. J. Crisick, Cleveland, show a 13.7% bettering of the frequency rate and 9.5% improvement in the severity rate over 1949.

Decrease in Death Toll

Crisick added that the death toll is likely to amount to 137, a decrease of 18%. In analyzing the 10-year fatality total of 1,160, D. C. Stewart, Niagara Mohawk Power Corp, said some 15% resulted from hand contacts and almost all of these could be attributed to the fact that the victims were not wearing rubber gloves.

S. H. Young, Hartford, reported progress in efforts to promote a uniform basis for accident reporting, particularly with regard to classification of injuries, inclusion of vacations, manhour computations, etc. At present there is wide diversity of practice. Similarly there was favorable consideration of the method Stewart advocated of weighing the severity index by adding days lost to cover the fatal and complete disability cases in arriving at an overall performance index for comparative purposes.

Concerted Action Needed

In welcoming the group to Baltimore C. P. Crane, president of Consolidated Gas Electric Light & Power Co of Baltimore, felt there was still plenty of latitude for concerted action to reduce the pain and cost of accidents. His company, he said, is critical and insistent on finding the causes of accidents to its employees. Such thoroughness is a factor in keeping all ranks "on their toes."

Comment on a report in the Dec. 23, 1950, issue of the "American Medical Association Journal" by University of Illinois physicians was one of dissent by Wills Maclachlan, Canada. The paper appeared to favor a combination of the Schafer and Emerson techniques, but Maclachlan elicited strong sentiment in favor of clinging to the orthodox Schafer prone pressure method after Chairman W. T. Rogers had called for a showing of hands on the issue.

Spiral grain is a frequent cause of rejection of ladders. One company reported rejection of 75% after emergency purchases. Another company had accepted at the factory only one in every twenty-five offered; the percentage is now somewhat higher. Fear was expressed that current market conditions may readily lead to inferior offerings.

Long Island Lighting Co had good response to letters advising customers that their television antenna installations were hazardous. A. S. Hancock said only 3 or 4 out of 125 so reported failed to relocate them as suggested.

Indications are that utilities will have available gloves and other basic protective equipment of natural rubber but that blankets, line hose, etc, will be essentially synthetic.

New equipment exhibited included a positive-pressure intermittent-action resuscitator by Mine Safety Appliances known as the Pneolator and offered as a supplement to the established Schafer procedure. Also shown were a safety-catch form of snap hook for linemen's belts (R. H. Buhrke Co) and a traffic-signaling lamp with Lucite extension to show either red or green (S. R. Browne Manufacturing Co).

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Branch Heads Utility

Harllee Branch, Jr., vice president and general manager of Georgia Power Co, has been elected president. He succeeds C. B. McManus, now administrator of the Defense Power Administration. McManus will continue as president of Southern Co and will serve as a vice president and chairman of a new executive committee of Georgia Power.

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Franchise Renewal OK'd

Palmer, Iowa, has approved Iowa Public Service Co.'s 25-year franchise renewal.

Campbell Is Recipient of Eta Kappa Nu Award

Dr. Donald P. Campbell, a professor at the Massachusetts Institute of Technology, was honored as the "outstanding young electrical engineer of 1950" by the Eta Kappa Nu Association Jan. 22 at New York. The presentation was made at a dinner held during the winter meeting of the American Institute of Electrical Engineers.

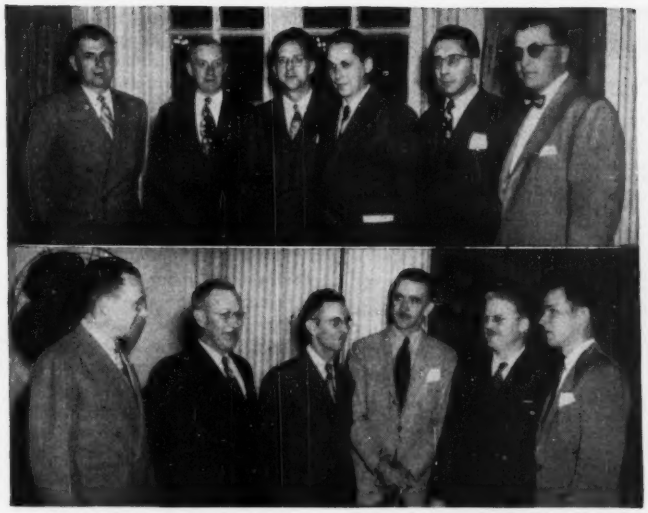
Three others received honorable mention. They were Kenneth A. Kesselring, assistant head of the engineering division of the Knolls Atomic Power Laboratory, operated by General Electric Co; A. W. Edwards, a section manager in the Switchgear Division of Westinghouse Electric Corp; and Robert W. Mayer, assistant to division engineer of special projects section of Aeronautics and Ordnance Engineering Division of General Electric.

DR. D. P. CAMPBELL

Purpose of the awards is to recognize young electrical engineers for "meritorious service in the interest of their fellow men."

Campbell first became associated with MIT as a graduate student in 1940. Upon completion of his courses he was appointed to the staff as a teaching assistant. During the war he lectured on servomechanisms theory to members of general advanced training programs for officers at MIT. He was also engaged in research and development in the institution's Servomechanisms Laboratory of automatic control mechanisms for both offensive and defensive weapons.

In 1949 he undertook an extensive lecture tour of Europe.



ALL FROM OHIO were these utility engineers at the Doble Engineering Conference. Standing, left to right, are E. E. Hartsock, Columbus & Southern Ohio Electric Co.; C. D. Price of the same company; A. E. Flink, Ohio Edison Co; D. D. Colker, Dayton Power & Light Co; R. E. O'Leary, Ohio Power Co; and D. W. Dewey, Cincinnati Gas & Electric Co. Other delegates in lower panel, left to right, are P. L. Bellaschi, Doble Engineering Co; W. A. Rey, Oklahoma Gas & Electric Co; F. O. December, San Antonio, Texas, Public Service Board; R. O. Hopkins, Gulf States Utilities Co; E. H. Gavlas, Aluminum Co of Canada; J. R. Brice, Tampa Electric Co

Materials, Manpower Conservation Is Emphasized at Doble Conference

The necessity for conservation of materials and manpower was stressed at the annual conference of Doble Engineering Co clients at Boston Jan. 8-12. Approximately 300 attended.

Discussion centered on the latest techniques in electrical insulation design, application, and testing devices to insure efficient operation of equipment. It was also pointed out that recently evolved techniques in relation to inhibited transformer oils give impetus to the current effort to gear the electrical industry for conservation in use of materials.

The impact of shortages of material and general importance of insulation to the sustained capability of power systems emphasize the need for taking steps to register priority requirements of the industry with government authorities, it was said. The opinion prevailed that discovery of incipient failures by frequent testing is even more important than before.

It was indicated that a possible increase of 5C in optimum temperatures above present, so-called normal 95C, hottest spot copper appears attainable in modern power transformers. This is equivalent to a 5% advance in load capability.

Several papers referred to the revelation of unusual incipient faults by power-factor tests. Other faults were spotlighted by the use of the gas-detector relay and the transformer-turn ratio test. The use of high-vacuum (2 to 3mm) drying of insulation and removal of residue products shortens drying time and more completely removes oxidation deteriorates. This is known as the "kidney system." It is also expected that less varnish will be used on transformers.

Progress was reported in locating and assessing corona damage in generators. Damage to both insulation and laminations was noted, and case studies of 25,000-kw and 45,000-kw units were presented. It was said that numerous insulation failures in equipment indicate the presence of corona phenomena outside the AIEE definition specified as visual evidence.

Clients reported about 20 million kw in ac generating capacity on their systems in an analysis of 27 insulation failures in 1950 involving about 550,000 kw. One operator reported success in detecting turn-to-turn shorts by observing changes in generator coil impedance after dc insulation tests have failed to show them.

Important advances were noted in the application of liquid insulation. Many utilities are now using inhibitors in treating oil. Wide interest was manifested in the economic phases of oil reclamation. Testimony was given by several speakers to the effect that reclamation cost ran around 50% of the expense of purchasing new oil. It was said, however, that adequate tests should precede conservation, for opinion trends toward contaminated or deteriorated oil as the major cause of transformer failures.

Other advances noted included provision for power-factor field tests of bushings without disconnecting them from related transformers, further studies of the possibilities of bushing standardization, wider use of gasketing materials, ac tests of contact resistance applicable to amortisseur windings, rebuilding bushings, and more convenient test methods for lighting arresters.

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Dismissal Motion Fails in Suit Hitting REA Loans

A motion by a group of federal officials to dismiss a suit brought against them by 10 Missouri and Arkansas electric companies has failed. Judge C. F. McLaughlin, U. S. District Court at Washington rejected the motion Jan. 22. The case can now be brought to trial.

The utilities acted to bar REA loans to co-op federations for generating and transmission facilities to be leased to the Southwestern Power Administration.

Defendants are SPA Administrator Douglas G. Wright, Interior Secretary Oscar L. Chapman, REA Administrator Claude R. Wickard, Agriculture Secretary Charles Brannan, and Treasury Secretary John Snyder.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1950									
Jan. 18	2.65	2.67	2.76	3.84	4.06	4.51	5.60	6.24	7.12
Jan. 11	2.64	2.67	2.76	3.83	4.09	4.50	5.63	6.30	7.20
END OF QTR.									
4th 1950	2.65	2.67	2.78	3.86	4.14	4.51	5.80	6.54	7.44
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67

Data: Reis & Chandler, Inc.

SEC 'Regulation as Usual' Shelved for AEC Project

Securities and Exchange Commission is shelving some of its normal standards temporarily to let five power companies join (EW, Dec 18, p 73) to build a $70-million power plant for a new Atomic Energy Commission project at Paducah, Ky.

The five utilities are forming a company known as Electric Energy, Inc. to help supply the project. SEC reserved the right to require them to divest themselves of Electric Energy's stock later under provisions of the Holding Company Act. But recognizing that "speed is of the essence," the commission said that Electric Energy could not be considered "business as usual" and merited postponement of "regulation as usual."

The plant will have four 125,000-kw units plus transmission lines to supply part of the power needed by the atomic project. AEC has agreed to give a 25-year contract subject to termination on a year's notice. If AEC cuts short the contract, the government will pay 28% of the cost of the power plant plus certain taxes and minus a credit which will be computed in relation to debt retirement.

Electric Energy's rates are expected to cover operating expenses, allow for 3% interest on debt, repay the loan over a 25-year period, and provide an 8% return on the common stock. Any excess power will go to the five stockholder utilties in proportion to their interests in the company.

Union Electric Co of Missouri will own 14,000 shares of the common stock, Central Illinois Public Service Co 7,000, Illinois Power Co, 7,000, Kentucky Utilities Co 3,500, and Middle South Utilities, Inc, 3,500. The utilities are to contribute $3.5 million for the stock. An additional $66.5 million will be loaned by two institutional investors.

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Union Electric Will Buy Missouri Power & Light

Union Electric Co of Missouri's application to acquire all the common stock of Missouri Power & Light Co, Jefferson City, has been approved by the Securities and Exchange Commission.

Addition of Missouri P&L's 65,669 electric customers will make Union Electric fifteenth among the nation's electric utilities in terms of customers served (EW, Oct 2, p 16). It will move Union Electric, which now serves 433,885 customers, up above Boston Edison Co, with 471,716, and Public Service Co of Northern Illinois, with 445,706.

The 1.5 million shares of Missouri Power & Light common outstanding will be purchased from North American Co in exchange for 600,000 shares of Union Electric common. North American is the parent company of Union Electric and of North American Light & Power Co, parent of Missouri P&L. North American Light & Power is being dissolved under an SEC order issued in 1942.

Union Electric plans to integrate the affiliated company's plants and lines into its own system. It was directed by SEC to dispose of Missouri P&L's water and ice business and the latter's electric properties in Clinton, Mo. Missouri P&L has been furnishing electric and gas service to various areas in north central Missouri.

FINANCIAL BRIEFS

Several months may elapse before the proposed public utility district purchase of Puget Sound Power & Light Co properties in Washington is completed, commissioners from eight PUD's were told at the annual convention of the Puget Sound Utility Commissioners' Association in Seattle. Harvey Benson of Skagit PUD, chairman of the association's acquisition committee, said technical issues are being worked out with the company and the city of Seattle. Benson was elected president of the association, with Ben Stockey of Thurston County as vice president and William McKenzie of Chelan County as secretary-treasurer.

Duquesne Light Co's $7,697,000-a-year rate increase, suspended since April 10, (EW, Oct. 16, p 14) went into effect automatically Jan. 10 because the Public Utility Commission was unable to dispose of the case in the nine months the law allows for suspension of a rate boost. A motion by the city of Pittsburgh to freeze rates at their present level pending final disposition of the case was denied by the PUC.

Columbus & Southern Ohio Electric Co has eliminated its 5% surcharge on electric bills in Gallipolis, Ohio, for the next two years.

Fort Smith, Ark., has increased its occupation tax on utilities operating there from $10,000 to $15,000 a year.

Electric Utility Financing—January 13-20

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
El Paso Electric	2⅞% 1980 ref and new money	$4,500	102.335%	2.76%
Preferred Stock				
San Diego Gas & Electric	325,000 sh 4.40% $20-par new money	6,825	$21.00	4.19
Common Stock				
Central Illinois Public Service	267,600 sh new money	4,248	15.875	7.56
SCHEDULED				
Bonds—Consolidated Gas Electric Light & Power Co of Baltimore, 1986 ref and new money, $25 million				

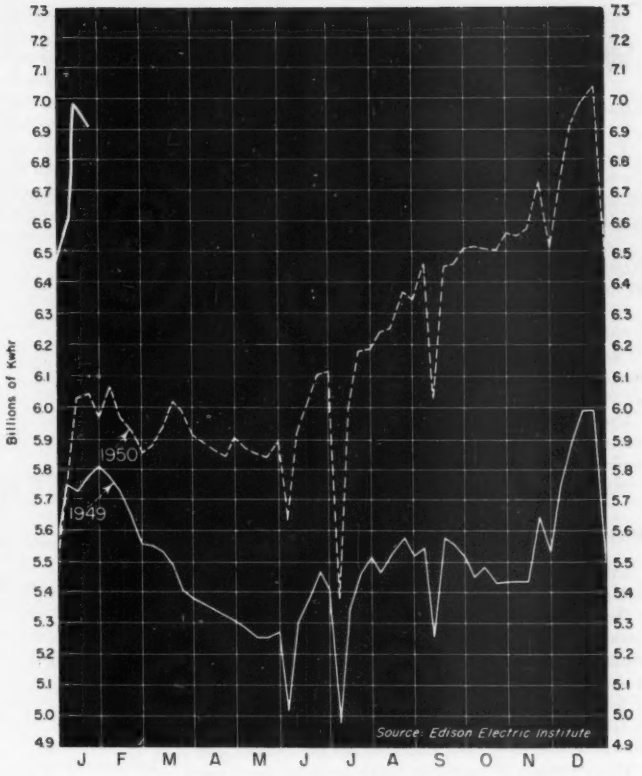
Freak Accident Causes Extensive Plant Damage

Freak failure of the steel operating rod of an old, vertical-type, segregated-phase circuit breaker at the Kearny (N. J.) Station of Public Service Electric & Gas Co recently resulted in sufficient damage to the armature of three of the station's 40,000-kw generators to require their rewinding.

The accident occured in the early morning hours of Dec. 28—the day after the system had experienced its winter peak load—when one of three 40,000-kw generators was being synchronized. As the machine was being closed in on the 13.2-kv bus, the breaker operating rod broke, jamming the mechanism with the contacts of one phase closed, the other two phases open. A single-phase fault ensued.

Relays attempted to trip the breaker in response to this indication but failed because the mechanism was inoperative. As a result the machine fell out of step but hung on the bus, creating a voltage disturbance that damaged the armature insulation of three associated 40,000-kw generators and flashed over the leads of two other units. The station's mercury-turbine installation was not in operation during the disturbance.

The generators and other apparatus directly affected by the accident were part of the original installation made at Kearny when the plant was built in 1926. Since that time the capacity of the station has been expanded from an initial 184,600 kw to its present 334,000-kw capacity.



Output Week Ended Jan. 20—6,908,818,000 Kwhr

Weekly Output, Millions Kwhr

1951		1950		1949	
Jan 20	6,909	Jan 21	6,041	Jan 22	5,769
Jan 13	6,981	Jan 14	6,029	Jan 15	5,727
Jan 6	6,602	Jan 7	5,695	Jan 8	5,742
1950		1949		Jan 1	5,562
Dec 30	6,479	Dec 31	5,493	1948	
Dec 23	7,033	Dec 24	5,994	Dec 25	5,508
Dec 16	6,985	Dec 17	5,997	Dec 18	5,790
Dec 9	6,909	Dec 10	5,881	Dec 11	5,705
Dec 2	6,716	Dec 3	5,743	Dec 4	5,646
Nov 25	6,508	Nov 26	5,537	Nov 27	5,349
Nov 18	6,728	Nov 19	5,644	Nov 20	5,627

Percent Change from Previous Year

	Jan 20	Jan 13	Jan 6
New England	+12.8	+11.9	+13.0
Mid-Atlantic	+13.6	+14.6	+15.5
Central Industrial	+15.2	+16.9	+16.2
West Central	+13.4	+13.2	+13.4
Southeast	+19.0	+25.1	+25.1
South Central	+17.3	+18.8	+19.6
Rocky Mountain	+ 5.9	+ 8.4	+ 8.5
Pacific Coast	+11.0	+ 8.8	+ 8.6
Total United States	+14.4	+15.8	+15.9

MEETINGS

National Rural Electric Cooperative Association
Annual Meeting, Cleveland Municipal Auditorium, Cleveland, Ohio, January 29-February 1.

★Pennsylvania Electric Association
Transmission and Distribution Committee, William Penn Hotel, Pittsburgh, February 1-2; Hydraulic Power Committee, Benjamin Franklin Hotel, Philadelphia, February 8-9; Systems Operation Committee, Robert Treat Hotel, Newark, N. J., February 8-9; Relay Committee, Hotel Roosevelt, Pittsburgh, Pa., February 15-16; Electrical Equipment Committee, Hotel Emerson, Baltimore, Md., March 1-2; Prime Movers Committee, Berkshire Hotel, Reading, Pa., March 8-9.

Missouri Valley Electric Association
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Missouri, February 8-9; Engineering Conference, President Hotel, Kansas City, Mo., April 4-6.

Edison Electric Institute
Electrical Equipment Committee, Hotel Cleveland, Cleveland, Ohio, February 12-13; Transmission and Distribution Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 15-16; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 2-5.

Adequate Wiring Bureau
Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.

Public Utility Buyers' Group of the National Association of Purchasing Agents
Mid-winter Conference, William Penn Hotel, Pittsburgh, Pa., February 18-20.

North Central Electrical Association
Electrical Industries Convention, Nicollet Hotel, Minneapolis, February 25-28.

American Society for Testing Materials
Spring Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, March 5-9.

National Electrical Manufacturing Association
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., March 12-15.

National Association of Corrosion Engineers
Conference and Exhibition, Hotel Statler, New York, March 13-16.

Protective Relay Engineers
Annual Conference, Agricultural & Mechanical College of Texas, College Station, Texas, March 26-28.

Oklahoma Utilities Association
Annual Convention, Mayo Hotel, Tulsa, Oklahoma, March 29-30.

American Institute of Electrical Engineers
District No. 4 Meeting, McFadden-Deauville Hotel, Miami, Fla., April 11-13.

Southeastern Electric Exchange
Engineering and Operation Section, Vinoy Park Hotel, St. Petersburg, Fla., March 29-30; Annual Conference, Boca Raton, Fla., April 11-13.

American Society of Mechanical Engineers
Spring Meeting, Atlanta Biltmore Hotel, Atlanta, Ga., April 2-5.

Electric Association of Chicago
Industrial Electrical Exposition, Sherman Hotel, Chicago, Ill., April 2-7.

Midwest Power Conference
Sherman Hotel, Chicago, April 4-6.

Northwest Electric Light & Power Association
Engineering Section, Hotel Utah, Salt Lake City, Utah, April 25-27.

★ Addition This Week

WASHINGTON COMMENT

RONALD D. ROSS

An important power recommendation of President Truman's Water Resources Policy Commission report may be tested formally before the commission even submits its proposals for writing its policy into law. While the commission was working this month on its legislative suggestions, the Federal Power Commission heard oral argument in the Roanoke Rapids case.

Now before FPC for decision are both the Roanoke Rapids license application of the Virginia Electric & Power Co and the Kings River license application of the Pacific Gas & Electric Co, the latter following a rehearing held last year on an FPC decision to grant a license.

These private utility applications for development of sites that Interior would like to add to its own vast power empire were dealt with pretty specifically in the Water Policy Commission's general report.

WRPC Sees Private Power a Threat

Taking note of the two cases, among others, WRPC declared:

"Issuance of such licenses to private power interests would have far-reaching effects upon federal water resources programs, and more especially upon power policy, an important factor in such programs. Power values created by federal investment in multiple-purpose programs would be utilized for private profit, instead of bringing about reductions in electric rates and expanded use of electricity."

This statement of the water policy commissioners' views was cited by counsel for the Secretary of Interior in the Roanoke Rapids argument. It brought a prompt answer by Vepco counsel:

"It may be the proposal of the present Water Resources Commission that the law should be changed to make every flowing stream a government project, as a yardstick for electric power rates from private industry, but that is not the law which this commission is to administer."

But Private Power Came First

Apart from the fact that the WRPC report is not law, it may be hoped that the Federal Power Commissioners will consider the WRPC statement.

In the first place, the idea that "issuance of such licenses to private power interests would have far-reaching effects upon federal water resources programs . . ." might better read that federal water programs have had "far-reaching effects" upon private water power development, "and more especially upon power policy . . ." Private power is not a new intruder in water resource development.

The opinion that "power values created by federal investment" would be "utilized for private profit" seems to denounce efforts of the commission to deal with head water benefits, as well as challenging FPC and other commissions for their handling of "private profit."

More important is the implication that denying licenses to private power companies on the Kings and Roanoke Rivers is a method of "bringing about reductions in electric rates and expanded use of electricity." Congress has steadfastly refused to show any interest in authorizing Kings River Power development by the Bureau of Reclamation. The Corps of Engineers has not sought funds to construct Roanoke Rapids. There is no prospect that the federal government, if these sites are reserved to it, will make any use of them in the immediate future. On the other hand, two private electric utilities are ready to start construction.

In short, water flowing to the sea does not seem likely to reduce anyone's electric bill, let alone expand the use of electricity.

Even with the WRPC report open before them, the Federal Power Commissioners may well decide to issue the licenses. It would be reassuring to those whose recommendations were so pointedly ignored by the men who prepared the WRPC report.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Pole installations of capacitors are four times as prevalent as rack-mounted and three times as prevalent as substation housed; outdoor types are 15 times more common on poles than the housed type.

Corrosion of anchor rods after loss of galvanizing can and probably will result if there is copper counterpoise in the immediate vicinity. Low earth resistance would accelerate the galvanic action.

Fatalities of linemen due to contacts above the elbow have been on the increase; rubber sleeves could reverse the trend even if they are uncomfortable in summer.

Carrying capacity of buried cables is a largely debatable quantity because of the uncertain variables. At least the thermal resistance of the sheath could be established even though soil factors have to await determination.

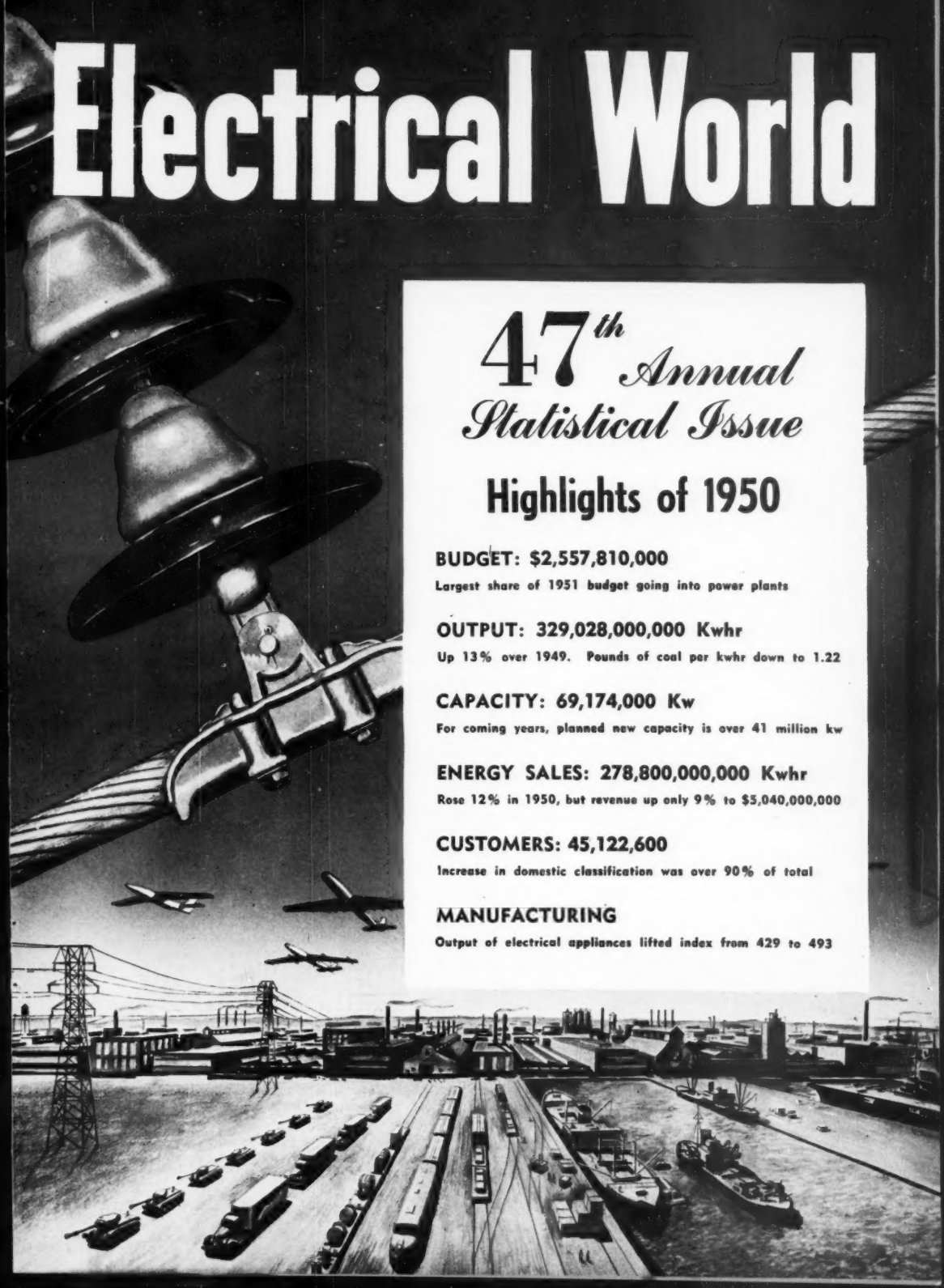
Lead is losing its secure place as the prime material for protective cable sheathing; the trend is to protect the protection with a protective synthetic resin. An ideal one might also supplant the cable insulation generally.

Electrical, physical and thermal properties of synthetic resins are important enough to deserve tabulation independently of ordinary industrial characteristics.

Unit stations, in the true sense, are very scarce if not nonexistent because, the several plant units generally use the same condensing water system, the same communications and the same control battery.

Ninety-six phase operation is reported for nearly 1/3 the mercury rectifier units used in the electrochemical industry; 12, 24, 60 and 72 phases have representation of between 11% and 14% of the units.

Electrical World



47th Annual Statistical Issue

Highlights of 1950

BUDGET: $2,557,810,000

Largest share of 1951 budget going into power plants

OUTPUT: 329,028,000,000 Kwhr

Up 13% over 1949. Pounds of coal per kwhr down to 1.22

CAPACITY: 69,174,000 Kw

For coming years, planned new capacity is over 41 million kw

ENERGY SALES: 278,800,000,000 Kwhr

Rose 12% in 1950, but revenue up only 9% to $5,040,000,000

CUSTOMERS: 45,122,600

Increase in domestic classification was over 90% of total

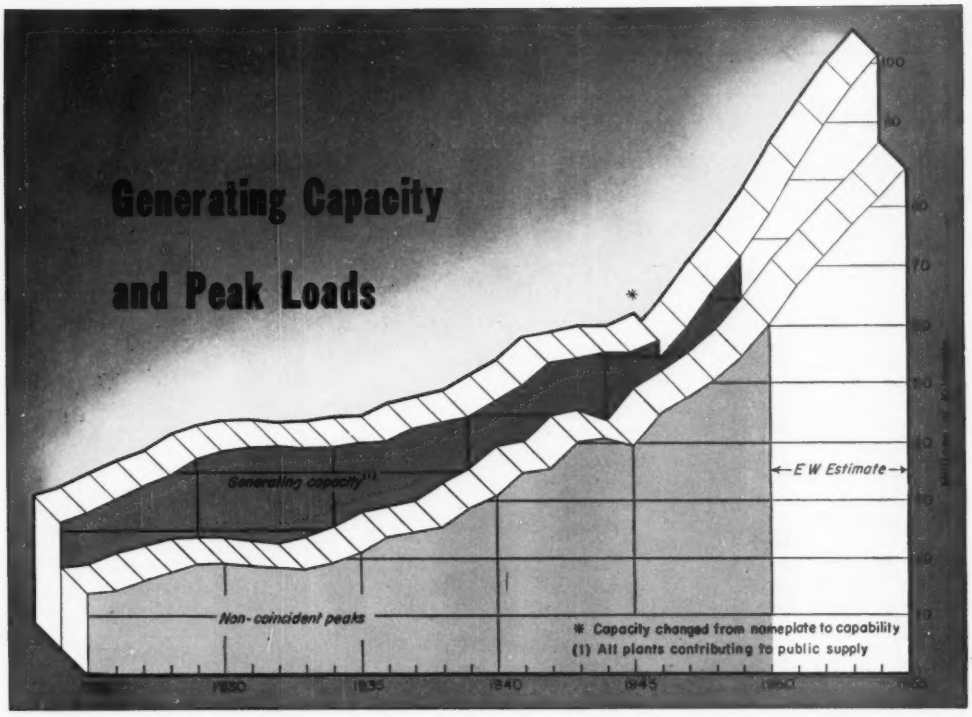
MANUFACTURING

Output of electrical appliances lifted index from 429 to 493

The Statistics Summarized

	1943	1944	1945	1946	1947	1948	1949	1950*
FINANCIAL[1]								
Fixed Capital ($1,000,000)	13,022	12,956	12,667	13,111	14,065	15,513	17,326	19,000
Securities issued ($1,000,000)	371	1,018	1,362	1,082	1,577	1,451	1,793	1,708
New capital	10	16	40	173	568	1,314	1,445	1,300
Refunding	361	1,003	1,322	910	1,010	136	348	408
INCOME and OUTGO[2] **($1,000,000)**								
Operating revenue	2,816	2,955	3,012	3,127	3,480	3,903	4,113	4,475
Operating expenses	1,127	1,225	1,259	1,385	1,701	2,026	2,030	2,139
Taxes	680	677	652	639	664	716	794	937
EXPENDITURES ($1,000,000)[2]								
Capital	306	340	409	718	1,372	2,078	2,518	2,347
REVENUE[2] **($1,000,000)**								
Total from customers	3,078	3,277	3,342	3,460	3,853	4,313	4,614	5,040
Rural[3]	77	83	90	105	124	141	161	160
Residential	1,029	1,098	1,167	1,241	1,366	1,533	1,716	1,915
Small Light and Power	774	817	850	925	1,031	1,153	1,229	1,320
Large Light and Power	964	1,043	1,002	969	1,107	1,251	1,263	1,385
Other	234	236	233	220	225	237	245	260
ENERGY SALES[2] **(1,000,000 kwhr)**								
Total to consumers	185,889	198,161	193,558	190,794	217,581	240,740	248,542	278,800
Rural[3]	2,996	3,373	3,668	4,431	5,551	6,327	7,384	7,450
Residential	28,621	31,266	34,184	38,571	44,171	50,978	58,139	66,450
Small Light and Power	29,071	29,837	30,438	33,016	88,379	43,193	46,262	50,050
Large Light and Power	105,778	115,187	107,490	98,885	113,523	124,088	120,766	138,350
Other	19,423	18,498	17,778	15,891	15,957	16,154	15,991	16,500
OUTPUT (1,000,000 kwhr)								
Generated	217,759	228,189	222,486	223,178	255,739	282,698	291,099	329,028
From fuel	144,127	154,244	142,516	144,772	177,314	200,228	201,351	233,596
From water power	73,632	73,945	79,970	78,406	78,425	82,470	89,748	95,432
CAPACITY (1,000 kw)								
Total generator ratings	47,951	49,189	50,111	50,317	52,322	56,560	63,100	67,509
Fuel	34,067	34,603	35,199	35,468	37,351	40,908	46,446	49,947
Hydro	13,884	14,586	14,912	14,849	14,971	15,652	16,654	17,562
FUEL CONSUMPTION[2]								
Coal (1,000 short tons)	77,300	80,080	74,720	72,200	89,530	99,950	83,960	87,940
Oil (1,000 bbl)	17,990	20,860	20,230	36,320	45,310	42,640	66,300	78,110
Gas (billion cu ft)	302	359	326	307	373	478	550	623
Pounds of coal per kwhr	1.30	1.29	1.30	1.29	1.31	1.30	1.26	1.22
CUSTOMERS (1,000)								
Total number	32,396	33,048	34,031	36,140	38,432	40,722	42,851	45,123
Rural[3]	1,088	1,144	1,234	1,381	1,522	1,695	1,804	1,608
Residential	26,872	27,371	28,117	29,769	31,622	33,549	35,375	37,622
Small Light and Power	4,168	4,263	4,398	4,693	4,961	5,132	5,291	5,496
Large Light and Power	147	153	162	175	191	204	232	239
Other	121	118	120	122	136	142	148	158
People in homes served (1,000)	105,000	107,000	110,000	115,000	123,000	130,000	134,000	141,500
Percent of total civil population	77.3	80.0	81	82	86	89	90	94
EMPLOYEES[4]	.....	.....	.....	.....	219,000	230,000	232,700	237,500

* Estimated, generally on ten months' operation. [1] Power companies. [2] Covers power companies, municipal utilities, and state authorities, but not rural cooperatives or Federal projects. [3] On specific rural rates only. [4] Covers employees in the electrical departments of power companies only; new series begun in 1947.



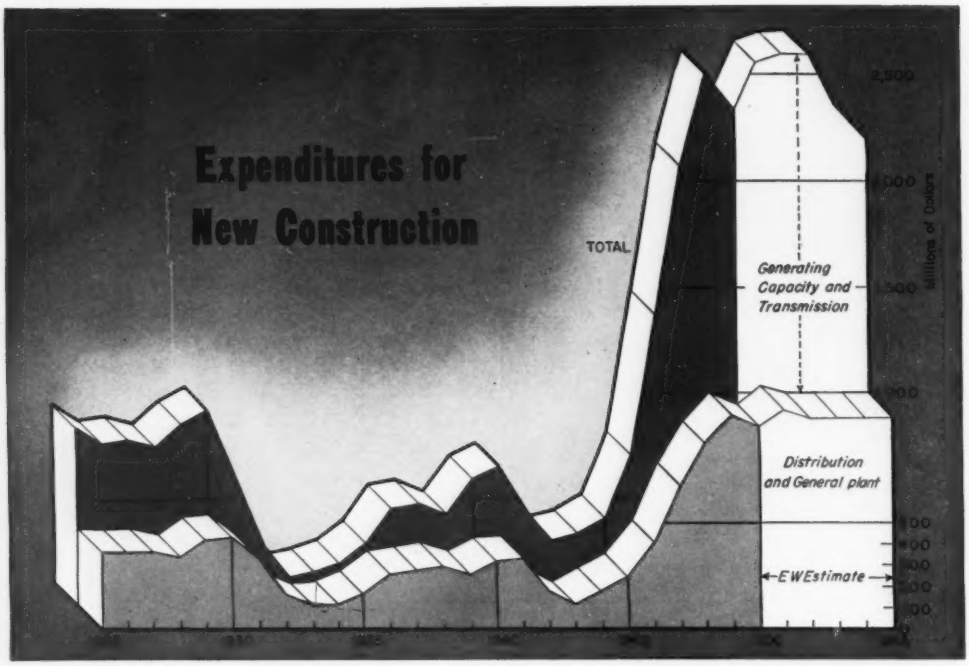
AT THE END OF 1955 generating capability will have risen from 66.7 million kw in 1950 to 102 million and peak load in that year from 60.25 to 86 million kw. These estimates represent increases of 53% in capability and 30% in peak

A Look Ahead

Predictions of 1955 capability and peak higher than a year ago

BEFORE LOOKING at the prospect ahead for the electrical industry, it is necessary to define the view. It does not include all-out war. It does take in all the factors of an economy rapidly growing more rigid as the requirements of defense cut into civilian goods production. It assumes that these requirements will become stabilized at some proportion of national production and that the remaining part will be sufficient to afford the people considerably more than bare subsistence although considerably less than they'd like to have. It may be hoped that increased productivity will mitigate the restrictive circumstances of living as time goes on. On this point the Council of Economic Advisers in its December 1950, report to the President, says, "It should be possible to increase the total of private and public output by about 25% over the next five years." The view, then, of this "Look Ahead" is to a stiffened economy in which people will live with not too much comfort, or discomfort, either. With this understood, let's look ahead.

In 1955, generating plants contributing to the public supply of electricity will be capable of carrying a load of 102 million kw. They will carry a peak load of 86 million kw, leaving 16 million as reserve, 18.6% of peak. The 1950 capability was 66.7 million kw, the peak load 60.2 million, the margin 6.5 million or 10.8%. The continuing program



CAPITAL EXPENDITURES of electric utilities are expected to remain about the same for the coming three years, then to taper off. Most of the decline will be in generation and transmission, with distribution and general plant little changed

of generating capacity installation will thus have widened the reserve margin to more comfortable size.

The load factor in 1949 was 61.8%. This is based on record figures. For 1950 the load factor is 62.3%. This estimate is based on the record of 10 months. For the end of the period it is assumed that the load factor will have declined as adjustment to the circumstances of the defense economy is accomplished. This reasoning results in an estimated output of 443 billion kwhr in 1955, which, with a peak load of 86 million kw, means a load factor of about 59%.

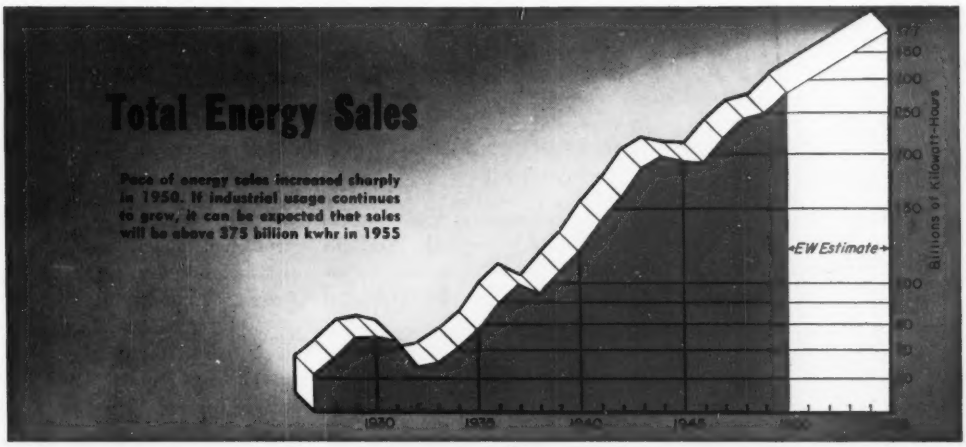
The energy output in 1950 of 329 billion kwhr was 13% above that of 1949. This spectacular increase was caused by an actual decrease in amount of electricity used by industrial customers in 1949 from 1948. In 1950 industrial energy usage came back with a bang. It is not likely that such an increase in output will be repeated in the next few years. The estimate of 443 billion kwhr for 1955 is based on a compounded increase of about 6% per year.

The distribution of gen-

[redacted]

	1950	1951	1952	1953	After 1954
Power companies	5,200	5,800	5,400	5,550	2,428
Electric cooperatives, public power districts and state projects	150	135	70	128	46
Municipal utilities	430	445	220	462	620
Federal government	920	1,320	2,010	1,313	15,208
Totals	6,700	7,700	7,700	7,453	18,302

* 1950–'51–'52, Edison Electric Institute. 1953–'54, Electrical World Survey.


Total Energy Sales
Pace of energy sales increased sharply in 1950. If industrial usage continues to grow, it can be expected that sales will be above 375 billion kwhr in 1955
EW Estimate
Billions of Kilowatt-Hours
1930
1935
1940
1945

Residential and Farm Sales		Small Light and Power Sales		Industrial and Other Sales	
1925	5,930	1925	8,850	1925	28,296
1930	12,492	1930	13,944	1930	40,148
1935	15,109	1935	13,588	1935	40,864
1940	25,309	1940	22,373	1940	59,557
1945	37,852	1945	30,438	1945	107,490
1947	49,722	1947	38,379	1947	113,523
1949	65,523	1949	46,262	1949	120,766
1950	73,900	1950	50,050	1950	138,350
1955	115,000	1955	70,000	1955	192,000

erating capacity among power companies, municipal utilities, federal projects, electric co-operatives and others, is shown in tabular form. Through 1953, the power companies are far in the lead in installation of new capacity. After 1953 federal hydro projects loom up. Of course, by that time the power companies will have added greatly to their present plans and the comparison then will not be so lop-sided as it is now.

The projected figures of expenditures for new construction on which an accompanying graph is erected are in 1950 dollars. No attempt was made to include the very likely factor of inflation which might make the $2.2 billion estimated for 1955 considerably larger. Offsetting this is another possibility. It is that unavailability of materials may reduce the construction program. Combination of these two possibilities might cause the projected $2.2 billion to land right on the nose of actuality but at a cost of unbuilt facilities horrible to contemplate. Federal, municipal and rural cooperative expenditures could easily add a third more to this figure.

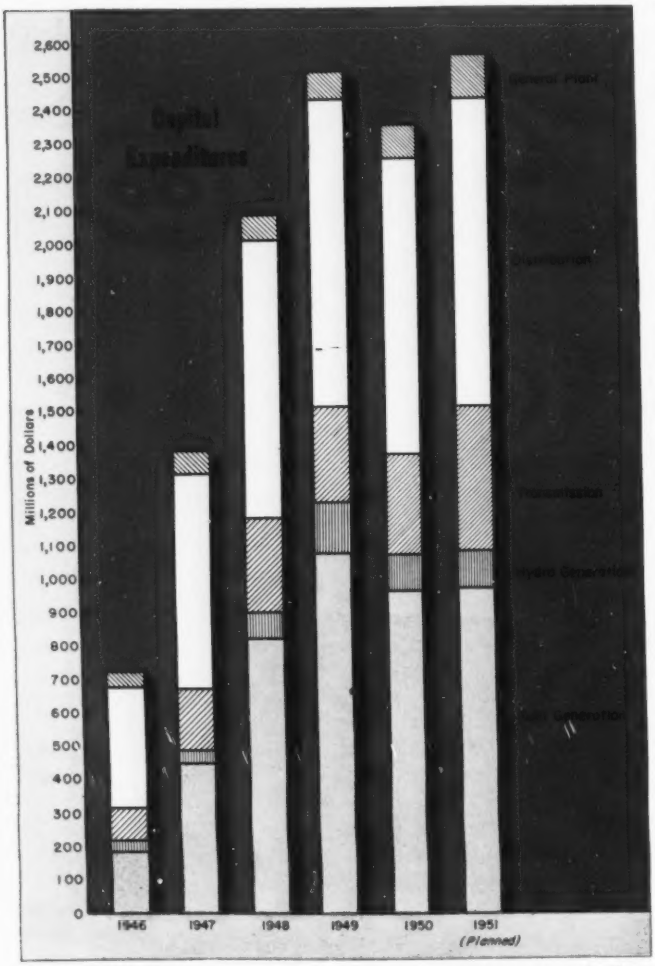
Data from Electrical World surveys on planned installation of new generating capacity indicate that construction expenditures for all system components will be maintained at about present levels or a little higher for the next two years. Supporting this indication is information on expected provision of power supply to atomic projects, such as Paducah where 1 million kw is planned, much of it to be in operation by 1953. After that, expenditures for generating capacity and transmission can be expected to slacken off. But distribution and other construction should maintain the present level, or rise higher, for years to come, even after 1955.

Electrical energy sales of 377 billion kwhr in 1955 represent an increase of over 36% from 1950. However, sales to residential and farm customers are expected to rise at a somewhat higher rate, about 55%.

1951 Budget Tops 1950

Construction will go on at rapid rate unless shortages prevent

OVER $3.2 billion is the estimate for construction of facilities for electricity supply to the people of this nation in 1951. This compares with a figure of 3 billion expended in 1950. Whether the construction contemplated in the 1951 budget will be wholly accomplished is problematical. If metal scarcities and other stringencies of a defense economy become progressively more acute, it is quite likely that 1951 capital expenditures will fall short of the presently estimated figure.



MAINTENANCE of the electric utilities' post-war construction program is shown by the continuing height of the bars. Present plans would hold them high

The total of $3.2 billion is the sum of estimates based on data furnished by: (1) Power companies, municipal and other state and local government utilities, including TVA; (2) federal agencies; and (3) electric cooperatives in Electrical World's annual survey of electric utility construction and capital expenditures. Combining the estimates of the three groups—$2,558,000,000 + $359,000,000 + $273,000,000—results in an industry total of $3,190 million for 1951.

The data obtained in the survey fall into three distinct groups. The first is comprised of group (1) above. The estimate for this group is solidly founded on survey returns representing 84% of the group in terms of customers served and 84.5% in terms of generating capacity installed. The 1951 budget for this group totals $2,558 million and is detailed in the accompanying tables and graphs.

Data for the estimates of expenditures by federal agencies, group (2) above, were obtained from the Bureau of Reclamation and the Corps of Engineers. Since the money for construction

by these agencies is provided by appropriations of the Congress, estimates of future expenditures are not so reliable as otherwise they would be. With this qualification, the figure of $359 million is added in.

In gathering group (3) data, questionnaires were sent to over 800 electric cooperatives. About 300 replies were received. Of these, a considerable number said "data not available," and other reported only partially. The net result was compilable data representing less than 20% of the cooperative segment of the light and power industry. Adequate data were not obtained from generating and transmission cooperatives. The returns received indicated a large reduction in construction expenditures in 1951 from 1950 of over 50%. Data from the Rural Electrification Administration, published elsewhere in this issue, show an increase of $273 million in 1950 in accumulated funds advanced by the Administration compared with $327 million for 1949. It has been assumed that this 1950 advance will be the capital expenditures of cooperatives for 1951. From the same sources and on the same bases, an estimated total of $3,031 million for construction expenditures in 1950 was arrived at — $2,347,000,000 + $357,000,000 + $327,000,000.

Data of the first group—power companies and municipal and other local government utilities —are the only figures amenable to break-down into amounts for geographical areas and for kinds of construction. These breakdowns appear in the tables and graphs.

In general, the distribution of the 1951 budget to the different kinds of construction is about the same as in 1950. Fuel power stations take 38% of the total in 1951 as against 41% in 1950. Distribution is down only slightly from 37 to 36%. Although their percentages in the total budget of 1951 are a little down from 1950, the 1951 dollar expenditures estimated for fuel power and for distribution are actually higher than in 1950. These two accounts, always taking up to 75% or more of the total budget, need change only little to make very large proportionate changes in the smaller construction accounts. Thus the percentage for transmission is much larger proportionately in 1951 (17%) than in 1950 (13%).

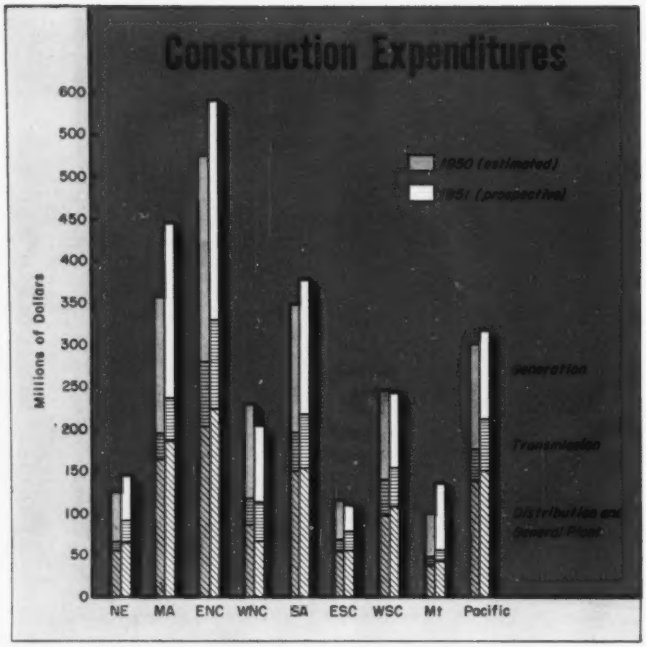
The effect of federal government activities in river development is plainly apparent in the continuing very small proportion of hydro power in electric utility construction. As in 1950, it is still less than 5% of the total in 1951.

Distribution of the 1951 budget over the nine Census regions of the nation shows little change from 1950. The highly industrialized East North Central region, which includes Ohio, Indiana, Illinois, Michigan and Wisconsin, again leads with nearly one quarter of the national total for electricity system construction. This region is highest in all kinds of construction except hydro power, in which it is lowest. Next in size of share of the total budget comes the Middle Atlantic region—New York, New Jersey and Pennsylvania—with the South Atlantic—Delaware, Maryland, District of Columbia, Virginia, West Virginia, North and South Carolina, Georgia and Florida—following quite closely. The Pacific region —Washington, Oregon and California—is fourth in line for all kinds of construction.

On the basis of new capacity installed in relation to construction expenditures, a unit figure of cost per system kilowatt may be calculated. For a single year the cost thus calculated has lit-

Year	Fuel	Hydro	Transmission	Distribution	General Plant	Total
1935	16,172	6,337	42,732	110,487	17,127	192,855
1936	36,820	9,030	55,305	184,725	24,000	289,710
1937	113,060	10,540	100,400	223,620	38,600	455,480
1938	133,000	17,600	59,200	238,200	34,000	482,000
1939	101,500	17,900	61,375	226,375	22,850	430,000
1940	200,430	9,270	84,780	266,580	35,520	596,580
1941	219,741	27,186	101,085	272,449	32,687	654,148
1942†	191,671	22,847	85,633	144,180	11,644	455,975
1943	137,059	35,505	42,923	84,683	6,066	306,286
1944	96,126	19,888	61,196	151,969	11,105	340,284
1945	106,166	12,713	68,935	204,492	16,623	408,929
1946	190,955	18,974	106,550	360,980	40,710	718,169
1947	440,547	40,901	195,074	624,038	71,585	1,372,145
1948	813,025	86,188	280,530	822,275	76,070	2,078,088
1949	1,078,081	150,653	288,358	916,475	84,047	2,517,614
1950	960,739	107,730	300,093	879,242	99,367	2,347,171
1951‡	967,613	109,817	433,059	918,944	128,377	2,557,810

Source: "Electrical World" surveys, rural cooperatives and federal projects not included.
† Expenditure study not made by "Electrical World" in 1942. Figures are those reported by Federal Power Commission for privately owned utilities only.
‡ Prospective.



LARGEST of the nine shares of the 1951 construction budget of electric utilities belongs to the East North Central region. Next comes the Middle Atlantic with South Atlantic third and Pacific fourth. In three regions budgets show declines

Construction Expenditures* As Reported to Electrical World
(Thousands of Dollars)

Region	Fuel	Hydro	Trans-mission	Distri-bution	General Plant	Total
ESTIMATED—1950						
New England	48,446	10,806	10,523	49,559	5,441	124,775
Middle Atlantic	159,784	3,757	31,688	152,795	10,294	358,318
East North Central	244,723	4,042	75,936	172,759	29,815	527,275
West North Central	109,946	1,176	32,708	73,284	12,344	229,458
South Atlantic	149,837	2,840	45,398	138,128	10,845	347,048
East South Central	45,824	968	15,107	44,438	8,855	115,192
West South Central	88,664	19,816	40,082	87,651	9,031	245,244
Mountain	50,795	3,204	10,090	32,049	4,405	100,543
Pacific	62,720	61,121	38,561	128,579	8,337	299,318
United States	960,739	107,730	300,093	879,242	99,367	2,347,171
PROSPECTIVE—1951						
New England	50,218	5,410	24,360	55,708	8,468	144,164
Middle Atlantic	195,553	12,671	52,258	165,671	18,335	444,488
East North Central	261,508	666	105,640	186,143	36,599	590,556
West North Central	85,483	3,214	46,306	54,556	12,525	202,084
South Atlantic	149,833	9,693	64,475	138,333	14,221	376,555
East South Central	30,226	1,796	21,033	48,621	7,788	109,464
West South Central	72,779	17,064	44,981	96,683	11,533	243,040
Mountain	55,721	21,586	13,962	36,682	5,703	133,654
Pacific	66,292	37,717	60,044	136,547	13,205	313,805
United States	967,613	109,817	433,059	918,944	128,377	2,557,810

* Covers power companies, state authorities and municipal systems. Does not include rural cooperatives and federal projects.

tle or no validity because of the overlapping of construction from one year to the next. In the six years, 1946-1951, new capacity has been and will be installed by the electric utilities (power companies and local government utilities) amounting to 22,871,000 kw. In the same period they expended and will expend a total $11,590 million for new construction. The cost per kw of new plant derived from these figures is $507.

Previous calculations of this unit cost for the 4- and 5-year terms ending 1949 and 1950 resulted in $548 and $528 respectively. The practically equal decline per year as the covered period increases suggests that the figure is gaining validity as a true expresson of average unit cost for new construction of electricity supply systems and that more confidence can be put in it as the years go on. When it remains about constant for two consecutive years, it may be taken as established for the conditions obtaining in the period covered.

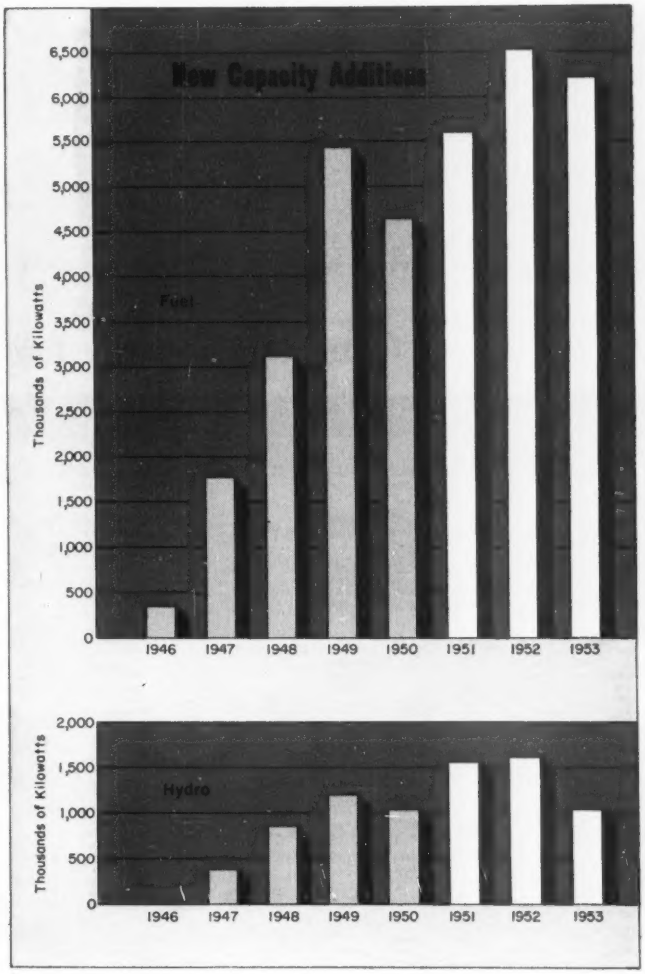
From data organized too late for tabular presentation in this issue, it is possible to indicate the growth since the war in the use of federal money for electricity supply. The figures that follow are totals of expenditures for new construction made by the Bureau of Reclamation, the Corps of Engineers and the Tennessee Valley Authority, plus loans made to REA cooperatives. In 1945, the federal interest was represented by expendidtures and loans totalling $102 million. For 1951, the indicated total is $872 million. In millions of dollars, the totals for the intervening years are: 1946, 105; 1947, 197; 1948, 340; 1949, 436; 1950, 771.

Many More Additions Planned

MORE NEW generating capacity than ever before is now planned by the electricity supply industry for the next three years. Prospective installation of new capacity in the years ahead totals over 41 million kw. Last year it was about 26 million kw. The difference between 26 and 41 million is a measure of how the sights of the industry have been raised in one year.

Of the above 41 million kw, 18 million are listed for installation after 1953, leaving 23 million for the years 1951-'52-'53. In last year's statistical issue, the 3-year look ahead for new capacity was 17 million kw.

Construction plans of the power companies account for about 17 of the 23 million kw in prospect for installation in this and the next 2 years. The remaining 6 million is divided about one third in local government and co-operative plants and two thrds in federal projects. A total of 50,000 kw of gas turbine capacity is planned.



New Capacity Added Each Year*

Year	Megawatts		
	Fuel	Hydro	Total
1938	1,350	346	1,696
1939	915	370	1,285
1940	1,361	332	1,693
1941	2,292	786	3,078
1942	1,756	1,027	2,783
1943	1,835	1,089	2,924
1944	778	768	1,546
1945	622	266	887
1946	355	6	361
1947	1,784	393	2,177
1948	3,132	880	4,012
1949	5,441	1,201	6,642
1950	4,719	1,067	5,786
1951†	5,675	1,574	7,249
1952†	6,538	1,613	8,151
1953†	6,316	1,110	7,426
After 1953†	3,193	15,109	18,302

Source: "Electrical World" Surveys.
* Before deduction of retirements. † Prospective for 1951 and later.

These data on new generating capacity were compiled from Electrical World's annual survey of electric utility construction and capital expenditures. Although not entirely complete they are offered as the most comprehensive available. One million kilowatts for the atomic energy plant at Paducah, Ky., have not been added to the data.

Summary of Capacity Additions

	1950	1951	1952	1953	After 1953
STEAM					
Power Companies	4,379,315	5,058,140	5,408,850	5,365,700	2,016,500
Local* and Federal	294,750	545,250	1,114,000	945,000	1,131,000
Totals, Steam	4,674,065	5,603,390	6,523,850	6,310,700	3,147,500
HYDRO					
Power Companies	336,120	176,466	439,100	184,500	379,000
Local and Federal	731,100	1,397,700	1,174,600	952,500	14,730,590
Totals, Hydro	1,067,220	1,574,166	1,613,700	1,147,000	15,109,590
INTERNAL COMBUSTION**					
Power Companies	24,544	29,840	14,750	.....	32,250
Local and Federal	19,985	42,055	.....	5,000	13,000
Totals, Internal Combustion	44,529	71,895	14,750	5,000	45,250
TOTALS, ALL POWER					
Power Companies	4,739,979	5,264,446	5,862,700	5,550,200	2,427,750
Local and Federal	1,045,835	1,985,005	2,288,600	1,902,500	15,874,590
Grand Totals	5,785,814	7,249,451	8,151,300	7,452,700	18,302,340

* Includes municipals, rural cooperatives, power districts and state projects. ** Includes gas turbine capacity additions.

Generating Capacity Additions

Reporting Systems	Added in 1950	1951	1952	1953	After 1953
Power Companies					
Alabama Power	.....	140,000	100,000	.....	.....
Appalachian Elec Pwr.	125,000	125,000	175,700	175,700	.....
Atlantic City Electric	.....	.....	.....	.....	60,000
Black Hills Pwr & Lgt.	11,500	10,000	.....	.....	.....
Boston Edison	.....	.....	81,250	.....	.....
California Elec Power	.....	.....	60,000	.....	40,000
Cambridge Elec Light	20,000	.....	.....	.....	.....
Carolina Power & Light	44,000	66,000	132,000	.....	.....
Central Arizona Lgt & Pwr	67,500	.....	.....	60,000	.....
Central Hudson Gas & Elec	.....	60,000	.....	60,000	.....
Central Ill Elec & Gas	.....	.....	30,000	.....	.....
Central Illinois Light	.....	.....	60,000	.....	.....
Central Illinois Pub Ser.	60,000	.....	60,000	.....	60,000
Central Kansas Power	6,000	6,000	.....	7,500	.....
Central Louisiana Elec	.....	20,000	.....	20,000	.....
Central Maine Power	.....	.....	60,000	.....	.....
Central Ohio Lgt & Pwr	10,000	.....	.....	30,000	.....
Central Power & Light	.....	30,000	30,000	.....	.....
Cheyenne Lgt Fuel & Pwr	.....	.....	.....	.....	10,000
Cincinnati Gas & Electric	.....	.....	100,000	100,000	.....
Citizens Utilities	.....	.....	5,000	.....	10,000
Cleveland Elec Illum.	.....	120,000	100,000	100,000	.....
Columbus & So Ohio Elec	40,000	.....	60,000	60,000	.....
Commonwealth Ed & Subs	257,000	150,000	110,000	150,000	.....
Concord Electric*	.....	7,125	.....	.....	.....
Connecticut Lgt & Pwr	.....	66,000	.....	.....	75,000
Con Edison of N. Y	.....	300,000	160,000	160,000	160,000
Con G E L & P Co of Baltimore	66,000	75,000	100,000	75,000	.....
Consumers Power	60,000	.....	170,000	.....	.....
Dallas Power & Light	25,000	60,000	.....	65,000	.....
Dayton Power & Light.	.....	120,000	30,000	120,000	.....
Delaware Power & Light	.....	132,000	.....	.....	66,000
Detroit Edison	100,000	200,000	.....	250,000	.....
Duke Power	70,000	180,000	200,000	250,000	.....
Duquesne Light	65,000	80,000	80,000	.....	.....
East Shore Pub Ser of Md	.....	30,000	.....	.....	.....
Empire District Electric	30,000	.....	.....	30,000	.....
Florida Power	.....	40,000	40,000	40,000	.....
Florida Power & Light.	20,000	33,000	75,000	75,000	.....
Georgia Power	200,000	.....	140,000	40,000	.....
Gulf Power	.....	.....	70,000	40,000	.....
Gulf States Utilities	120,000	75,000	60,000	.....	.....
Hartford Electric Light.	45,000	.....	.....	60,000	.....
Houston Lgt & Pwr.	108,000	75,000	100,000	100,000	100,000
Indiana-Michigan Electric	.....	125,000	125,000	.....	.....
Indianapolis Pwr & Lgt.	40,000	40,000	.....	60,000	.....
Interstate Power & Sub.	11,500	11,500	25,000	.....	20,000
Illinois Power	120,000	.....	.....	150,000	.....
Iowa Elec Light & Power	45,000	20,000	.....	15,000	60,000
Iowa-Illinois Gas & Elec	.....	.....	20,000	.....	.....
Iowa Power & Light	40,000	.....	.....	60,000	40,000
Iowa Public Service	.....	32,500	11,500	.....	.....
Jersey Central Pwr & Lgt	.....	.....	62,500	.....	.....
Kansas City Pwr & Lgt	.....	132,000	.....	.....	66,000
Kansas Gas & Electric	.....	.....	40,000	60,000	.....
Kentucky Utilities	60,000	30,000	60,000	60,000	120,000
Lake Superior Dist Pwr.	6,800	.....	20,000	.....	.....
Long Island Lighting	44,000	.....	99,000	99,000	.....
Louisville Gas & Electric	.....	.....	60,000	.....	.....
Luzerne Co Gas & Elec	.....	.....	.....	20,000	.....
Maine Public Service	7,500	.....	.....	.....	12,500
Metropolitan Edison	75,000	75,000	.....	75,000	.....
Middle South Utilities	138,000	334,000	232,000	99,000	.....
Minnesota Pwr & Lgt.	.....	33,000	.....	88,000	.....
Mississippi Power	.....	40,000	.....	40,000	.....
Missouri Power & Light	11,500	.....	.....	.....	.....
Monongahela Power	.....	80,000	75,000	.....	.....
Montana Power	.....	66,000	.....	.....	.....
Montaup Electric	.....	60,000	.....	.....	.....
Mt Carmel Pub Utility	.....	7,500	.....	.....	.....
New Bedford Gas & Ed Lgt	30,000	.....	.....	.....	.....
New England Electric	33,000	75,000	75,000	70,000	.....
N. Y. State Elec & Gas.	70,000	75,000	50,000	100,000	.....
Niagara-Mohawk Power	160,000	80,000	160,000	200,000	.....
No Indiana Pub Ser.	70,015	70,015	.....	.....	.....
North States Pwr (Minn)	65,000	32,500	60,000	40,000	90,000
Northwestern Public Ser	.....	.....	.....	.....	11,500
Ohio Edison	90,000	.....	.....	212,000	.....
Ohio Power	125,000	.....	125,000	.....	.....
Oklahoma Gas & Elec.	50,000	50,000	30,000	.....	.....
Otter Tail Power	15,000	.....	.....	.....	.....
Pacific Gas & Electric	300,000	400,000	200,000	200,000	100,000
Patchogue Elec Lgt.	.....	.....	.....	.....	10,000
Pennsylvania Electric	46,000	.....	63,250	66,000	66,000
Pennsylvania Power	.....	.....	85,000	.....	.....
Pennsylvania Pwr & Lgt	.....	100,000	.....	125,000	.....
Philadelphia Electric	165,000	.....	125,000	275,000	150,000
Potomac Edison	.....	.....	60,000	.....	.....
Potomac Electric Power	80,000	.....	25,000	80,000	.....
Public Service of Colo.	40,000	87,500	.....	67,500	.....
Public Service of Ind.	40,000	100,000	90,000	90,000	.....
Pub ic Service of N. H.	.....	.....	40,000	.....	.....
Public Service of Okla	33,000	6,000	75,000	.....	150,000
Public Service Elec & Gas	.....	125,000	145,000	145,000	.....
Rochester Gas & Electric	50,000	.....	.....	50,000	.....
Rockland Light & Power	.....	22,000	.....	50,000	18,000
San Diego Gas & Electric	50,000	.....	50,000	.....	.....
Scranton Electric	.....	.....	.....	.....	44,000
So Carolina Elec & Gas.	22,500	40,000	.....	60,000	.....
So California Edison	.....	.....	125,000	125,000	.....
Southern Colorado Pwr.	.....	7,500	.....	.....	.....
So Indiana Gas & Electric	.....	20,000	.....	.....	.....
Southwestern Gas & Elec	30,000	30,000	30,000	40,000	.....
Southwestern Public Ser	37,500	37,500	50,000	.....	.....
St Joseph Light & Power	12,500	20,000	.....	.....	30,000
Superior Water Lgt & Pwr	.....	.....	12,650	.....	.....
Tampa Electric	60,000	.....	.....	.....	.....
Telluride Power	.....	.....	.....	5,000	5,000
Texas Electric Service	119,500	.....	119,000	.....	.....
Texas Power & Light	.....	.....	.....	75,000	75,000
Toledo Edison	.....	60,000	.....	.....	100,000

* Includes Exeter & Hampton Electric and Fitchburg Gas & Electric.

Reporting Systems	Added in 1950	1951	1952	1953	After 1953
Power Companies					
Union Elec of Mo & Subs	160,000	.....	110,000	.....	110,000
United Illuminating	30,000	.....	.....	.....	30,000
Upper Peninsula Power	.....	15,000	.....	.....	.....
Utah Power & Light	44,000	66,000	75,000	.....	.....
Virginia Elec & Pwr	60,000	100,000	90,000	150,000	.....
West Penn Power	46,000	.....	.....	.....	.....
West Texas Utilities	.....	25,000	.....	66,000	.....
Western Colorado Pwr	.....	5,000	.....	5,000	.....
Western Lgt & Tel	5,000	.....	.....	7,500	7,500
Western Mass. Electric	.....	.....	.....	45,000	.....
Wisconsin Electric Pwr	80,000	.....	120,000	.....	120,000
Wisconsin Pwr & Lgt	.....	60,000	.....	60,000	.....
Wisconsin Pub Ser	.....	62,500	.....	62,500	.....
Totals	4,379,315	5,058,140	5,408,850	5,365,700	2,016,500
Co-ops, Municipals, Public Utility Districts, State and Federal Projects					
Alabama Electric Co-op	.....	.....	15,000	.....	.....
Ames, Iowa	7,500	.....	.....	.....	.....
Austin, Texas	20,000	20,000	.....	.....	60,000
Brazos Riv Trans Elec Co-op	11,500	11,500	.....	.....	.....
Burbank, Calif	.....	.....	30,000	.....	.....
Central Iowa Pwr Co-op	20,000	20,000	.....	.....	.....
Central Power Elec Co-op	.....	30,000	.....	.....	.....
Chambersburg, Penn	.....	5,000	.....	.....	5,000
Clarksdale, Miss	.....	.....	7,500	.....	.....
Coffeeville, Kan	.....	.....	.....	.....	15,000
Colorado Springs, Colo	10,000	.....	.....	.....	15,000
Columbia, Mo	.....	.....	.....	12,500	.....
Corn Belt Power Co-op	15,000	11,500	15,000	.....	.....
Dairyland Pwr Co-op	17,250	17,250	.....	30,000	30,000
Danville, Va	.....	.....	10,000	10,000	.....
Detroit, Mich	40,000	.....	.....	.....	.....
East Ky R Elec Co-op	.....	.....	.....	40,000	.....
Eugene, Ore	11,500	.....	.....	.....	.....
Fairbury, Neb	4,000	.....	.....	.....	.....
Fremont, Neb	10,000	.....	.....	.....	10,000
Glendale, Calif	.....	.....	20,000	.....	.....
Grand Haven, Mich	.....	.....	.....	.....	6,000
Hannibal, Mo	10,000	.....	.....	.....	.....
Hastings, Neb	6,000	.....	.....	.....	.....
Hibbing, Minn	.....	.....	.....	7,500	.....
Holyoke, Mass	7,500	.....	.....	.....	.....
Jonesboro, Ark	.....	.....	7,500	.....	.....
Kansas City, Kan	.....	30,000	.....	.....	120,000
Lamar, Colo	.....	5,000	.....	.....	.....
Lafayette, La	.....	8,000	.....	.....	.....
Lakeland, Fla	22,000	.....	.....	.....	.....
Lincoln, Neb	.....	.....	.....	7,500	.....
Los Angeles, Calif	.....	.....	.....	100,000	300,000
Lubbock, Texas	.....	11,500	11,500	.....	20,000
Manitowoc, Wis	10,000	.....	.....	.....	20,000
Marshfield, Wis	6,000	.....	.....	.....	.....
McPherson, Kan	7,500	.....	.....	.....	12,500
Minnkota Power Co-op	5,000	11,500	.....	.....	.....
Muscatine, Iowa	12,500	.....	.....	.....	.....
Nebraska Public Power	15,000	30,000	.....	50,000	.....
No East Mo El Pwr Co-op	3,500	.....	.....	.....	.....
No Michigan Elec Co-op	.....	.....	15,000	.....	.....
Omaha Public Power Dist	.....	40,000	.....	.....	.....
Orrville, Ohio	.....	.....	.....	10,000	.....
Owatonna, Minn	4,000	.....	.....	.....	.....
Painesville, Ohio	.....	.....	.....	.....	7,500
Pasadena, Calif	.....	.....	.....	40,000	.....
Piqua, Ohio	.....	12,500	.....	.....	.....
Provo, Utah	.....	.....	.....	10,000	.....
Rushville, Ind	.....	.....	.....	5,000	.....
Salt River Power Dist	.....	.....	30,000	.....	.....
San Antonio, Texas	.....	30,000	.....	60,000	.....
Sanitary Dist, Chicago	.....	10,000	.....	.....	.....
South Haven, Mich	.....	.....	.....	.....	7,500
So Western Fed Pwr Co-op	15,000	.....	.....	7,500	.....
Tennessee Valley Auth	.....	225,000	900,000	540,000	495,000
Traverse City, Mich	.....	5,000	.....	7,500	.....
Vineland, N. J.	.....	.....	7,500	.....	.....
Virginia, Minn	.....	.....	7,500	.....	.....
Washington, Ind	.....	.....	7,500	.....	.....
Watertown, S. D.	.....	.....	.....	.....	7,500
Webster City, Iowa	4,000	.....	.....	.....	.....
Wellston, Ohio	.....	1,500	.....	.....	.....
Western Electric Co-op	.....	.....	30,000	.....	.....
Winnetka, Ill	.....	.....	.....	7,500	.....
Wyandotte, Mich	.....	10,000	.....	.....	.....
Totals	294,750	545,250	1,114,000	945,000	1,131,000

Reporting Systems	Added in 1950	1951	1952	1953	After 1953
Power Companies					
Alabama Power	.....	.....	55,000	.....	.....
California-Oregon Power	42,950	40,000	35,000	60,000	.....
Central Hudson Gas & Elec	.....	.....	25,000	.....	.....
Central Maine Power	6,000	.....	.....	40,000	.....
Central Vermont Pub Ser	70	2,500	.....	.....	.....
Georgia Power	.....	20,000	45,000	.....	.....
Green Mountan Power	.....	.....	4,000	.....	.....
Holyoke Water Power	.....	15,000	.....	.....	.....
Idaho Power	50,000	.....	82,500	.....	.....
Maine Public Service	.....	.....	.....	9,000	9,000
Nantahala Power & Light	3,000	6,366	.....	.....	.....
New England Electric	33,000	.....	.....	.....	.....
Niagara-Mohawk Pwr Corp	.....	.....	30,000	.....	.....
North States Pwr (Minn)	.....	.....	8,000	.....	.....
North States Pwr (Wis)	36,000	.....	4,200	30,000	.....
Pacific Gas & Electric	163,500	.....	.....	33,000	279,000
Portland General Elec	.....	5,000	.....	.....	.....
Rochester Gas & Electric	.....	3,600	.....	.....	.....
Southern California Edison	.....	84,000	.....	.....	.....
Union Elec of Mo & Sub's	1,600	.....	400	.....	.....
Upper Peninsula Power	.....	.....	.....	7,500	.....
Virginia Electric & Power	.....	.....	.....	.....	91,000
Washington Water Power	.....	.....	.....	150,000	.....
Wisconsin Public Service	.....	.....	.....	.....	5,000	.....
Totals	336,120	176,466	439,100	184,500	379,000
Co-ops, Municipals, Public Utility Districts, State and Federal Projects					
Central Kansas Elec Co-op	.....	5,000	.....	.....	.....
Consumers Pub Pwr Dist	1,600	.....	.....	.....	.....
Dairyland Power Co-op	.....	15,000	.....	.....	4,000
Eugene, Ore	12,500	.....	.....	.....	.....
French Broad Elec Memb	.....	.....	1,500	.....	12,500
Los Angeles, Calif	.....	112,500	.....	.....	.....
Lower Colo River Aut	14,000	75,000	.....	.....	.....
No East Mo El Pwr Co-op	.....	.....	15,000	.....	.....
No Michigan Elec Co-op	.....	200	.....	.....	.....
Provo, Utah	.....	.....	.....	.....	1,000
Seattle, Wash	.....	60,000	90,000	180,000	.....
Tacoma, Wash	.....	30,000	.....	.....	.....
Tennessee Valley Auth	115,000	96,800	243,100	98,000	44,000
US Bureau of Reclamation	417,000	726,800	373,000	159,500	745,090
US Corps of Engineers	171,000	276,400	452,000	515,000	13,924,000
Totals	731,100	1,397,700	1,174,600	952,500	14,730,590

Reporting Systems	Added in 1950	1951	1952	1953	After 1953
Power Companies					
Bangor Hydro-Electric	6,000*	6,000*	.....	.....	15,000*
Central Electric & Gas	1,340	1,340	.....	.....	.....
Central Maine Power	4,000	.....	.....	.....	.....
Central Ohio Lgt & Pwr	875	.....	.....	.....	.....
Central Vt Pub Ser	.....	6,000*	6,000*	.....	6,000*
Citizens Utilities	.....	.....	2,500	.....	.....
Florida Public Utilities	1,435	.....	.....	.....	.....
Iowa Public Service	.....	.....	2,500	.....	.....
Middle South Utilities	100	.....	.....	.....	.....
North States Pwr (Minn)	.....	1,000	.....	.....	.....
Northwestern Pub Ser	4,464	2,500	2,500	.....	.....
Patchogue Electric Light	.....	.....	.....	.....	10,000
Public Electric Light	2,000	.....	.....	.....	.....
Public Service of Okla	.....	6,000*	.....	.....	.....
Sac County Electric	1,230	.....	1,250	.....	1,250
Texas Power & Light	.....	6,000**	.....	.....	.....
Utah Power & Light	.....	1,000	.....	.....	.....
Virginia Elec & Pwr	600	.....	.....	.....	.....
Western Light & Tel	2,500	.....	.....	.....	.....
Totals	24,544	29,840	14,750	.....	32,250
Co-ops, Municipals, Public Utility Districts, State and Federal Projects					
Border Counties Pwr Co-op	.....	1,800	.....	.....	.....
Carthage, Mo	.....	.....	.....	5,000	.....
Clarksdale, Miss	.....	.....	.....	.....	2,500
Dairyland Power Co-op	5,400	.....	.....	.....	.....
Grand Haven, Mich	.....	5,000	.....	.....	.....
Harrisonburg, Va	.....	4,545	.....	.....	.....
Hudson, Mass	3,000	.....	.....	.....	.....
Kamo Electric Co-op	1,000	.....	.....	.....	.....
Lake Worth, Fla	.....	5,000	.....	.....	.....
M&A Elec Pwr Co-op	.....	10,000	.....	.....	.....
Nebraska City, Neb	.....	2,000	.....	.....	3,000
No. East. Mo El Pw Co-op	8,940	.....	.....	.....	.....
Nor Michigan Elec Co-op	.....	1,600	.....	.....	.....
Norwich, Conn	.....	.....	.....	.....	7,500
Vero Beach, Fla	.....	2,000	.....	.....	.....
West Minn Pwr Co-op	.....	2,610	.....	.....	.....
Wolverine Electric Co-op	1,645	7,500	.....	.....	.....
Totals	19,985	42,055	.....	5,000	13,000

* Gas Turbines. ** Includes 5,000-kw gas turbine.

Number and Installed Capacity of Electric Utility Generating Plants
By States and Type of Prime Mover
Preliminary as of November 1, 1950

Census Region and State	Number[a] of Utilities	Number[b] of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by[b]					
				Water Power		Steam Power		Internal Combustion Engines	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	1,584	3,883	67,509,268	1,460	17,562,530	1,054	48,068,458	1,369	1,878,280
New England	102	323	3,965,056	217	932,951	67	2,970,715	39	61,390
Maine	18	86	389,936	62	264,762	6	104,000	18	21,174
New Hampshire	12	51	383,741	43	246,235	5	133,250	3	4,256
Vermont	20	77	193,174	61	166,487	7	14,750	9	11,937
Massachusetts	36	72	1,644,724	32	164,247	33	1,461,775	7	18,702
Rhode Island	6	10	362,421	4	3,250	5	358,950	1	221
Connecticut	10	27	991,060	15	87,970	11	897,990	1	5,100
Middle Atlantic	108	342	13,038,921	179	1,602,423	134	11,382,622	29	53,876
New York	56	211	6,099,487	149	1,154,847	44	4,905,695	18	38,945
New Jersey	11	20	2,047,556	3	6,350	14	2,038,024	3	3,182
Pennsylvania	41	111	4,891,878	27	441,226	76	4,438,903	8	11,749
East North Central	296	688	15,613,928	297	825,323	238	14,505,407	153	283,198
Ohio	58	98	4,364,646	6	11,525	72	4,325,793	20	27,328
Indiana	46	81	2,102,099	22	36,944	42	2,027,645	17	37,510
Illinois	62	99	4,209,013	12	48,629	59	4,108,344	28	52,040
Michigan	63	212	3,236,072	130	384,515	34	2,740,225	48	111,332
Wisconsin	67	198	1,702,098	127	343,710	31	1,303,400	40	54,988
West North Central	478	907	4,915,197	124	577,625	215	3,571,227	568	766,345
Minnesota	82	175	1,135,300	41	137,927	50	857,851	84	139,522
Iowa	98	205	1,097,536	31	136,916	48	743,949	126	216,671
Missouri	75	115	950,436	7	150,573	29	700,165	79	99,698
North Dakota	14	46	181,534	.....	.....	17	145,540	29	35,994
South Dakota	39	74	161,732	5	3,421	11	92,412	58	65,899
Nebraska	83	155	575,312	35	142,403	26	350,160	94	82,749
Kansas	87	137	813,347	5	6,385	34	681,150	98	125,812
South Atlantic	139	395	8,726,993	162	2,297,201	126	6,283,918	107	145,874
Delaware	5	6	27,648	.....	.....	4	23,150	2	4,498
Maryland	13	28	1,093,420	3	271,325	14	807,525	11	14,570
District of Columbia	2	3	508,000	1	3,000	2	505,000	.....	.....
Virginia	23	75	1,203,751	39	182,678	19	997,004	17	24,069
West Virginia	12	36	1,255,989	10	100,880	16	1,150,010	10	5,099
North Carolina	29	82	1,757,238	50	661,860	19	1,070,771	13	24,607
South Carolina	12	42	825,622	27	652,595	9	167,430	6	5,597
Georgia	12	46	1,056,216	28	412,202	14	640,950	4	3,064
Florida	31	77	999,109	4	12,661	29	922,078	44	64,370
East South Central	56	126	4,419,221	38	2,675,758	54	1,718,577	34	24,886
Kentucky	13	31	906,819	4	270,860	23	629,551	4	6,408
Tennessee	14	36	1,622,598	22	1,192,935	10	426,450	4	3,213
Alabama	4	25	1,689,763	12	1,211,963	9	475,340	4	2,460
Mississippi	25	34	200,041	.....	.....	12	187,236	22	12,805
West South Central	171	397	4,545,307	37	463,747	103	3,768,965	257	312,595
Arkansas	21	42	452,751	7	145,508	14	283,695	21	23,548
Louisiana	30	60	868,327	.....	.....	12	806,700	48	61,627
Oklahoma	49	97	723,377	4	73,624	24	582,320	69	67,433
Texas	71	198	2,500,852	26	244,615	53	2,096,250	119	159,987
Mountain	175	415	3,354,327	194	2,264,080	67	916,928	154	173,319
Montana	14	32	442,071	19	425,938	4	11,968	9	4,165
Idaho	14	50	430,599	41	425,615	1	400	8	4,584
Wyoming	26	53	139,139	17	78,997	11	50,820	25	9,322
Colorado	45	88	406,222	29	87,660	23	289,648	36	28,914
New Mexico	22	42	280,728	4	24,910	13	222,392	25	33,426
Arizona	19	53	832,268	14	540,540	11	228,950	28	62,778
Utah	27	80	227,628	60	94,145	4	112,750	16	20,733
Nevada	8	17	595,672	10	586,275	.....	.....	7	9,397
Pacific	59	290	8,930,318	212	5,923,422	50	2,950,099	28	56,797
Washington	20	53	2,765,298	38	2,564,036	9	197,820	6	3,442
Oregon	19	74	973,003	52	765,679	13	199,110	9	8,214
California	20	163	5,192,017	122	2,593,707	28	2,553,169	13	45,141

Notes: [a] Total includes 82 duplications because of utilities having generating plants in more than one state.
[b] For the approximately 169 combination plants each type of prime mover is counted as a separate plant.

More Higher Voltage Lines

Capacity additions pace transmission and substation construction

Region	1947	1948	1949	1950	1951
New England	421	497	546	717	1,148
Middle Atlantic	1,259	2,193	1,950	2,658	2,667
E. N. Central	1,235	3,399	3,887	3,972	4,926
W. N. Central	491	1,414	1,936	2,229	2,058
South Atlantic	764	1,935	2,545	2,848	3,083
E. S. Central	349	683	943	1,871	2,325
W. S. Central	754	996	2,284	2,609	1,951
Mountain	266	601	912	817	623
Pacific	1,228	2,441	2,775	2,094	3,089
United States	6,767	14,158	17,779	19,815	21,870

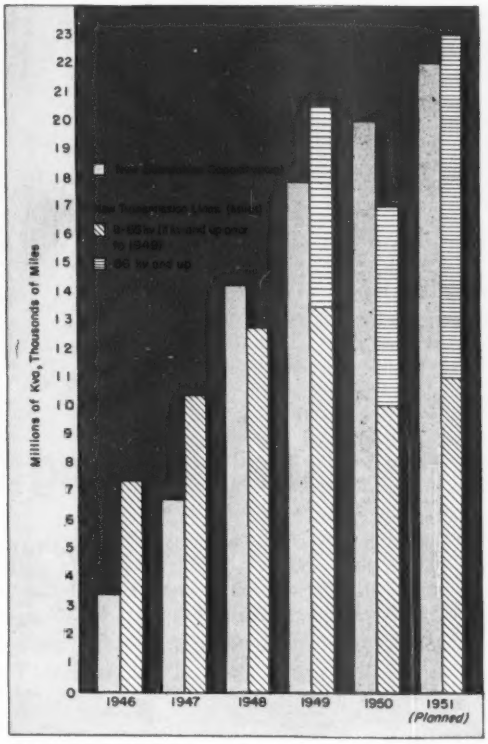
Source: " Electrical World " Surveys.

Region	1947	1948	1949	1950	1951
New England	13,495	12,170	14,337	14,631	20,255
Mid. Atlantic	25,902	31,160	37,793	42,495	59,015
E. N. Central	32,915	49,095	54,015	59,847	81,618
W. N. Central	13,059	15,755	47,766	27,784	20,172
So. Atlantic	19,621	31,170	43,608	34,426	34,260
E. S. Central	6,379	11,050	14,859	7,337	9,362
W. S. Central	13,083	17,275	32,446	29,165	32,390
Mountain	4,870	11,245	15,048	10,432	12,295
Pacific	27,790	52,690	57,667	42,697	61,532
United States	157,114	231,610	317,541	268,814	330,899

Source: " Electrical World " Surveys.

Region	1949 (11–65 kv)	1949 (66 kv and up)	1950 (11–65 kv)	1950 (66 kv and up)	1951 (11–65 kv)	1951 (66 kv and up)
New England	167	91	227	113	273	307
Mid. Atlantic	790	488	823	480	1,124	465
E. N. Central	1,834	1,359	1,025	1,195	1,456	1,857
W. N. Central	1,292	905	1,274	472	1,368	1,894
So. Atlantic	2,467	982	3,019	1,167	3,415	1,751
E. S. Central	375	439	573	514	728	1,680
W. S. Central	3,823	1,166	1,378	1,172	1,397	1,655
Mountain	1,933	730	539	812	657	654
Pacific	755	968	757	881	757	1,297
United States	13,436	7,128	9,615	6,806	11,175	11,560

Source: " Electrical World " Surveys.

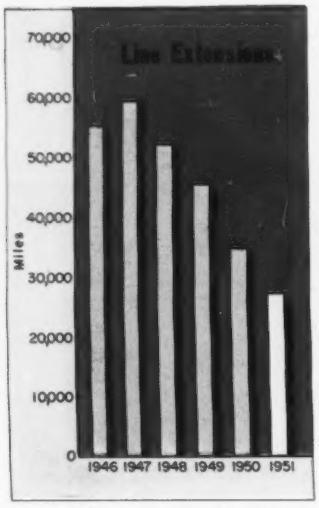


TRANSMISSION LINE construction planned for 1951 rose by 40% over 1950 while substation construction climbed steadily

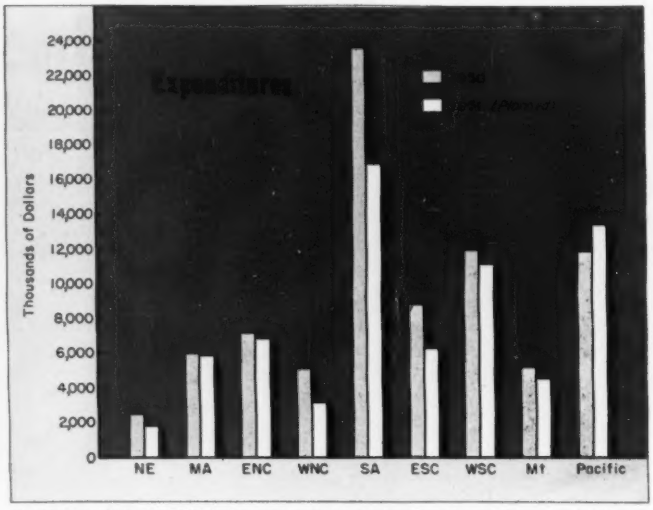
MILES of transmission lines planned for construction in 1951 by electric utilities exceed miles of line built in 1950 by about 40%. The increase in lines of 66 kv and above is 70% while the increase in lines of 11 to 65 kv is only 16%.

In capacity, 1951 substation construction is planned about 10% higher than the 1950 figure. In dollars, the increase of 1951 over 1950 is 23%.

These construction data are for power companies and for municipal and other local government systems, including the Tennessee Valley Authority. They do not include construction on federal projects and by rural electric cooperatives.



RURAL LINE building by electric utilities is slowing up significantly



PLANNED EXPENDITURES for rural line construction by utilities in 1951 are highest in the South Atlantic region, are below 1950 in all regions except Pacific

Line Building Slowing Down

But construction expenditures still continue at high level

CAPITAL EXPENDITURES for electricity supply to rural America still remain high—$343 million—despite the fact that the job of just building distribution lines for that service is approaching its end. Electric utilities in 1951 will spend over $70 million for rural line extensions. This estimate is firm. It is based on returns in Electrical World's annual budget survey representing

Region	1947	1948	1949	1950	1951
New England	1,873	2,138	808	1,052	751
Middle Atlantic	6,138	3,515	2,995	1,878	1,551
E. N. Central	7,038	7,362	4,103	2,806	2,421
W. N. Central	5,653	6,576	4,776	2,768	1,862
South Atlantic	14,143	12,810	12,538	11,036	7,906
E. S. Central	6,377	4,506	4,947	4,397	3,394
W. S. Central	9,004	7,815	7,030	5,465	4,782
Mountain	2,254	3,357	3,012	2,499	1,699
Pacific	6,647	4,298	5,253	3,028	2,962
United States	59,127	52,377	45,462	34,929	27,382

Source: "Electrical World" Surveys.
Rural cooperatives not included.

Region	1949	1950	1951
New England	1,723	2,446	1,771
Middle Atlantic	8,555	6,021	5,902
E. N. Central	10,655	7,231	6,932
W. N. Central	7,169	5,116	3,201
South Atlantic	23,971	23,680	16,928
E. S. Central	9,103	8,805	6,253
W. S. Central	12,301	11,953	11,213
Mountain	4,290	5,105	4,522
Pacific	13,897	11,871	13,496
United States	91,666	82,228	70,218

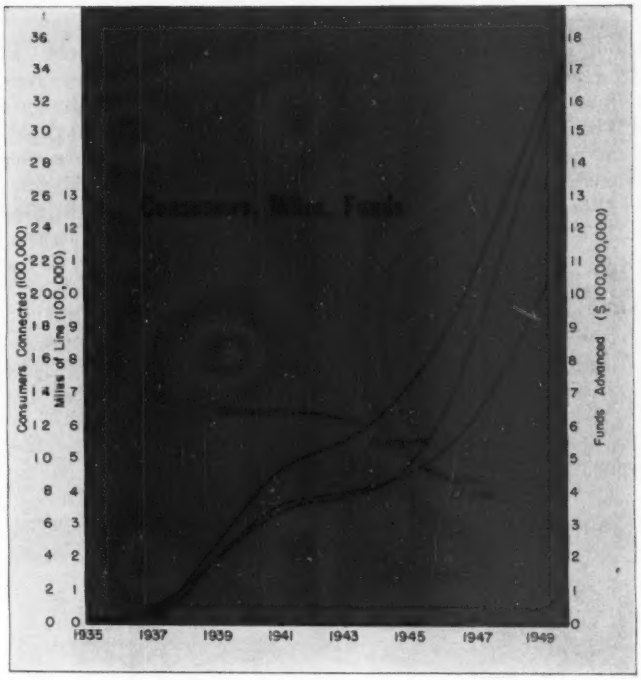
Source: "Electrical World" Surveys.
Rural cooperatives not included.

84% of the utilities in terms of customers served. The amount to be spent in 1951 by the REA borrowers is estimated at $273 million.

The budget survey covered the co-operatives as well as the utilities. But the returns from co-operatives were not sufficient to justify them as basis for estimate. Alternatively, it was assumed that the funds advanced by REA in 1950 represent construction planned for 1951. The $273 million thus taken is the difference between accumulated funds advanced in 1949 and 1950 as shown in the accompanying table of REA borrowers' operating data. It can be argued that part of the funds advanced in 1950 were expended in that year, but off-setting this is the fact that a portion of the loans approved in 1950 will be advanced and used for construction in 1951. Thus the $273 million remains as the best estimate of co-operatives expenditures planned for 1951.

It is evident from the survey returns that a considerable part of the money expended by co-operatives in 1951 will be for generating plants and transmission lines. Another large share will be for increase and improvement of service on lines already built.

In 1949 the utilities and co-operatives together added some 229,000 miles of line and in 1950, 185,000. In 1951 the prospect is for the utilities to build about 27,000 miles as against 35,000 in 1950. What the co-operatives will build cannot be estimated, but the indication of the survey returns received from them is that their new mileage in 1951 will be less than in 1950 and that, in turn, was less than in 1949.



FUNDS ADVANCED to borrowers are increasing at a faster rate than miles of line constructed, faster also than number of consumers connected

REA approval of loans to co-operatives and other borrowers now totals $2,311 million. Funds advanced in 1950 were $273 million, making the accumulated total at the end of the year $1,706 million. It is interesting to observe from the table of REA data here presented and from the same table published in

REA Cooperative Funds, Miles and Consumers

End of Year	Funds Advanced	Miles of Lines	Consumers Connected
1935	$10,000	0	0
1936	3,338,668	3,000	7,508
1937	34,338,022	16,500	43,878
1938	88,344,934	67,409	176,382
1939	184,099,271	181,359	435,566
1940	253,335,726	267,846	674,495
1941	332,033,107	348,062	902,266
1942	364,324,196	378,015	1,012,284
1943	378,496,489	390,058	1,087,801
1944	406,370,722	410,471	1,216,798
1945	463,541,933	449,579	1,408,918
1946	595,730,269	506,838	1,683,901
1947	821,142,824	603,064	2,046,095
1948	1,105,867,987	759,494	2,518,450
1949	1,433,200,126	943,385	3,040,425
1950	1,706,000,000	1,091,000	3,420,000

Source: Rural Electrification Administration.

previous years that the difference between loans approved and funds advanced has risen from $203 million in 1945 to $605 million in 1950.

The figures for co-ops show a sharp drop in 1950 in increase of systems in operation. The rise in 1948 was 41, in 1949, 43, but in 1950 only 12. There is also a decrease in the annual gain of miles of line in operation. In 1949 the gain was 184,000 miles and in 1950, 148,000. The same slowing up of growth is noted in consumers connected—522,000 in 1949 and 380,000 in 1950.

Systems operating generating plants increased by only one in 1950, but the capacity of plants rose about 85,000 kw.

Energy usage continues to climb steadily. In 1948 the average annual usage per consumer was 2,084 kwhr, in 1949, 2,241, and in 1950, 2,415. Corresponding growth in annual bill—$66.35 in 1948, $70.78 in 1949, $74.86 in 1950—and decline in average revenue per kwhr—3.18¢ in 1948, 3.16¢ in 1949, 3.1¢ in 1950—are to be noted.

The margin between revenue from, and operating cost to, the average consumer is getting wider. In 1948 it was $23.65, in 1949, $26.41, and in 1950, $28.54. From these amounts come interest and debt repayments on loans. In this connection are to be noted the increases in funds advanced per average consumer—$439 in 1948, $471 in 1949, and $499 in 1950.

Cost of energy per consumer rose from $23.17 in 1948 to $24.02 in 1949 to $24.46 in 1950. The more rapid rise in usage per consumer is reflected in the decline in unit cost of input energy which was 9.22 mills in 1948, 8.97 mills in 1949 and 8.54 mills in 1950. Operating costs per consumer other than for energy took a rather sharp upward turn in 1950, rising $1.52 to $21.86 in 1950 as against a rise of only 75¢ in 1949.

Increased usage by consumers and consequent better loading of systems are shown in the declining loss ratios obtained by dividing energy sales by system inputs. From 17.1% in 1948, losses dropped to 16.4% in 1949 and to 15.7% in 1950. This is continuation of a trend previously established.

Going along with this gradual decrease in energy losses is a gradual decline in average number of consumers per mile of line. Going back to previous publication of these data, in 1948 the figure of consumers per mile was 3.32. In 1949, it was 3.22 and in 1950, 3.12. Another figure, based on loan estimates as of Dec. 31, 1950, is an even 3.

Another parallelism is to be seen in the slow decrease in operating ratio—operating expense divided by revenue. In 1950 the ratio was 61.9%. It was 62.7% in 1949 and 64.4% in 1948. Summing up, it may be said that the increasing energy usage per consumer on co-operative lines is effectively countering higher costs, as is evidenced by the declining operating ratio.

ITEM	Calendar Year 1948	Calendar Year 1949	Calendar Year 1950[1]
CUMULATIVE YEAR-END DATA			
Total Loans Approved	$1,574,924,461	$1,999,279,707	$2,311,000,000
Distribution Lines	$1,374,738,875	$1,657,444,285	$1,879,000,000
Generation and Transmission	$186,266,998	$327,420,834	$413,000,000
Consumer Facilities	$13,918,588	$14,414,588	$19,000,000
Funds Advanced	$1,105,867,987	$1,433,200,126	$1,706,000,000
Systems in Operation	952	995	1,007
Miles of Line in Operation	759,494	943,385	1,091,000
Consumers Connected	2,518,450	3,040,425	3,420,000
Systems Generating Power During Year	96	95	96
Generating Plants—Kw Capacity	252,868	310,579	396,000
ANNUAL DATA			
Energy Generated—Kwhr	718,282,593	903,411,574	1,108,000,000
Energy Purchased—Kwhr	5,018,725,352	6,541,739,108	8,143,000,000
Total System Input—Kwhr	5,737,007,945	7,445,150,682	9,251,000,000
Energy Sold—Kwhr	4,757,051,392	6,227,471,179	7,800,000,000
Operating Revenues	$151,434,599[3]	$196,717,304[3]	$241,800,000
Cost of Power[2]	$52,877,700	$66,756,385	$79,000,000
Distribution Expenses—Operations	$11,072,150	$14,426,638	$18,300,000
Distribution Expenses—Maintenance	$7,272,900	$8,813,891	$11,000,000
Consumers Accounting and Collecting	$5,856,880	$7,433,996	$9,200,000
All Other Operating Expenses	$20,503,639	$25,872,562	$32,100,000
Total Operating Expenses	$97,583,269	$123,303,472	$149,600,000
Net Non-Operating Margin	$754,462	$633,346	$800,000
Interest Expenses	$14,803,674	$20,132,708	$25,600,000
Net Revenue Before Depreciation	$39,691,386[4]	$53,805,906[4]	$67,400,000
Depreciation	$24,906,720	$35,907,025	$47,500,000
Net Margin After Depreciation	$14,784,666	$17,898,881	$19,900,000

Source of Data: Monthly Operating Reports of REA borrowers and records of the REA.

[1] Based on nine months actual data and one to three months estimated.

[2] Cost of Power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.

[3] Does not include revenues reported by REA borrowers from whom figures for other items were not available: $239,198 for 6 borrowers for 1948 and $311,289 for 9 borrowers for 1949.

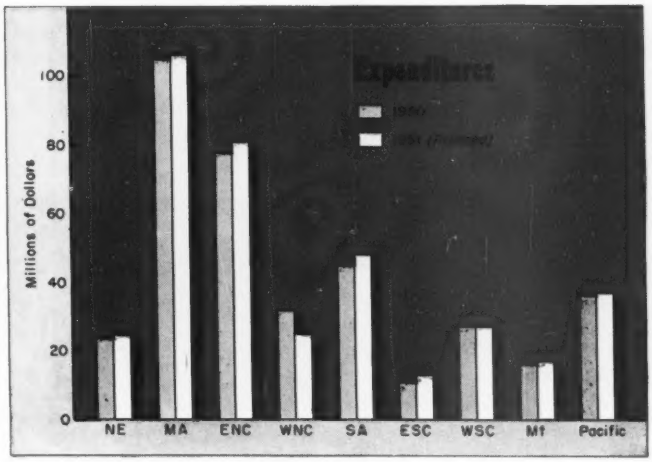
[4] After deducting miscellaneous revenue deductions not shown separately: $110,732 for 1948 and $108,564 for 1949.

New Facilities Reduce Maintenance

Effect of post-war building program is felt in maintenance costs

Region	1950	1951
New England	24,335	25,004
Mid. Atlantic	104,816	106,330
E. N. Central	77,724	80,963
W. N. Central	31,612	25,429
South Atlantic	44,536	48,401
E. S. Central	11,374	13,000
W. S. Central	26,906	27,254
Mountain	16,266	16,585
Pacific	35,860	36,616
United States	373,429	379,582

Source: "Electrical World" Surveys.



EXPENDITURES for maintenance in 1950 were highest in the Middle Atlantic states. The cause of this was undoubtedly damage from storms

THE SLIGHT INCREASE in maintenance expenditures contemplated for 1951 over the amount spent in 1950 indicates that any long-standing deferment of maintenance from the war years has finally been erased. The slowly declining trend of steam plant maintenance in the total, as appears in the table of FPC data at the bottom of this page, is evidence of the increasing employment of new equipment of improved design in generation of electricity.

The FPC data cover fewer utilities than do the figures based on Electrical World surveys in the smaller table. The data show total maintenance costs increasing at a much lower rate than that of growth of systems. These figures also indicate the effect of employment of new facilities on maintenance expense.

	1945	1946	1947	1948	1949
Steam	79,751—40.8%	77,327—37.3%	96,683—37.8%	109,489—37.4%	117,864—36.8%
Hydro	12,033— 6.2	11,287— 5.4	12,056— 4.7	12,798— 4.3	15,584— 4.9
Int. Comb	1,116— 0.6	1,365— 0.7	1,784— 0.7	2,392— 0.8	2,054— 0.6
Transmission	16,753— 8.6	18,846— 9.2	22,414— 8.8	24,335— 8.3	28,069— 8.8
Distribution	79,416—40.5	91,484—44.1	114,160—44.5	134,939—45.9	145,639—45.5
General	6,445— 3.3	6,926— 3.3	8,892— 3.5	9,771— 3.3	10,723— 3.4
Totals	195,514—100	207,235—100	255,989—100	293,654—100	319,933—100

Source: Federal Power Commission.

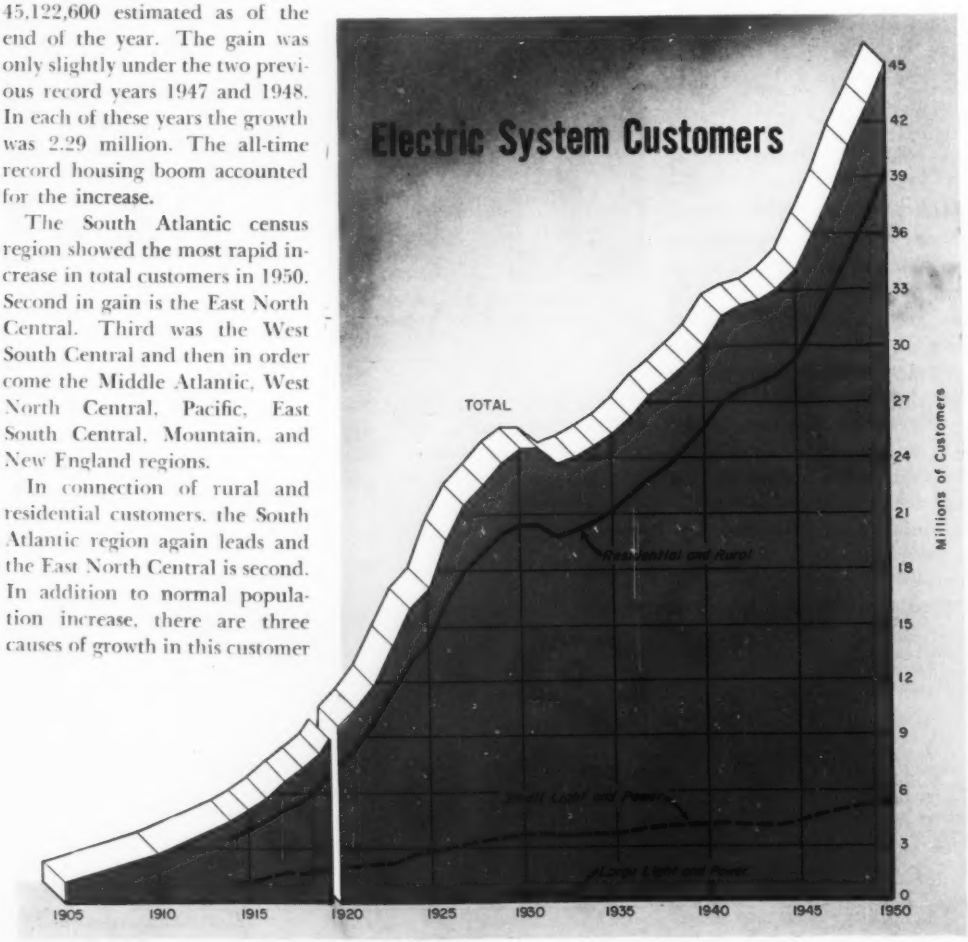
Near-Record Increase in 1950

Southeastern states continue to add most new customers

MORE CUSTOMERS were added to electric utility lines in 1950, nearly 2.27 million, than in 1949, just over 2.13 million. The over 5% increase in 1950 brought the total up to 45,122,600 estimated as of the end of the year. The gain was only slightly under the two previous record years 1947 and 1948. In each of these years the growth was 2.29 million. The all-time record housing boom accounted for the increase.

The South Atlantic census region showed the most rapid increase in total customers in 1950. Second in gain is the East North Central. Third was the West South Central and then in order come the Middle Atlantic, West North Central, Pacific, East South Central, Mountain, and New England regions.

In connection of rural and residential customers, the South Atlantic region again leads and the East North Central is second. In addition to normal population increase, there are three causes of growth in this customer class in any region: migration into the region, provision of new housing, and connection of previously unserved dwellings. All three of these causes were probably equally important in their several degrees in putting the South Atlantic region in the top place of gain in number. In the East North Central region,



Customers at the End of the Year, by States and Classifications*

Census Region and State	Total		Residential and Rural		Small Light and Power		Large Light and Power		Other	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
UNITED STATES	42,850,781	45,122,600	37,179,781	39,229,800	5,290,768	5,496,000	232,125	238,800	148,107	158,000
New England	3,004,800	3,094,000	2,613,989	2,693,600	360,882	370,900	19,802	19,000	10,127	10,500
Maine	302,216	311,600	257,754	266,100	37,133	38,200	4,153	4,100	3,176	3,200
New Hampshire	191,878	199,400	167,310	173,900	21,633	22,300	678	800	2,257	2,400
Vermont	123,412	125,500	107,609	109,600	13,965	14,000	756	800	1,082	1,100
Massachusetts	1,496,935	1,536,600	1,303,513	1,339,200	183,284	186,600	7,163	7,700	2,975	3,100
Rhode Island	252,097	259,300	220,514	226,700	29,854	30,800	1,347	1,400	382	400
Connecticut	638,262	661,600	557,289	578,100	75,013	79,000	5,705	4,200	255	300
Middle Atlantic	9,252,207	9,546,200	7,901,217	8,163,500	1,287,089	1,316,100	38,455	39,800	25,446	26,800
New York	4,670,028	4,795,600	3,966,090	4,074,700	680,741	696,800	7,896	7,900	15,301	16,200
New Jersey	1,538,736	1,602,900	1,322,090	1,380,700	206,924	212,200	7,810	8,000	1,912	2,000
Pennsylvania	3,043,443	3,147,700	2,613,037	2,708,100	399,424	407,100	22,749	23,900	8,233	8,600
East North Central	9,173,526	9,491,500	8,050,755	8,342,200	1,053,240	1,082,700	38,800	34,800	30,731	31,800
Ohio	2,400,454	2,479,100	2,107,561	2,177,900	265,451	276,700	15,779	12,300	11,663	12,200
Indiana	1,225,154	1,269,400	1,070,751	1,111,800	139,225	143,000	8,848	8,100	6,336	6,500
Illinois	2,562,940	2,639,400	2,231,833	2,299,500	314,831	322,900	8,686	9,100	7,590	7,700
Michigan	1,913,144	1,994,600	1,695,226	1,770,400	211,771	218,400	3,495	3,000	2,652	2,800
Wisconsin	1,071,834	1,109,000	945,384	982,600	121,962	121,700	1,998	2,100	2,490	2,600
West North Central	4,109,843	4,375,400	3,553,889	3,807,100	527,111	539,000	15,803	15,700	13,040	13,600
Minnesota	921,295	973,200	805,783	856,000	111,978	113,500	1,341	1,400	2,193	2,300
Iowa	815,643	852,900	699,331	733,900	107,506	110,100	6,638	6,700	2,168	2,200
Missouri	1,119,480	1,186,000	977,481	1,042,500	137,262	138,500	2,372	2,500	2,365	2,500
North Dakota	146,086	169,100	121,833	143,700	23,688	24,700	48	100	517	600
South Dakota	162,375	181,800	135,267	154,500	25,794	26,400	564	100	750	800
Nebraska	376,318	405,600	321,813	348,400	50,939	53,500	789	800	2,777	2,900
Kansas	568,646	606,800	493,381	528,100	69,944	72,300	4,051	4,100	2,270	2,300
South Atlantic	5,083,488	5,522,400	4,454,141	4,860,800	585,829	614,200	25,516	28,700	17,002	18,700
Delaware	95,047	101,600	82,618	88,300	11,910	12,700	393	400	126	200
Maryland	792,848	836,900	690,736	724,100	103,227	106,500	5,402	5,800	483	500
Virginia	756,993	814,600	663,663	718,400	85,632	88,800	1,221	1,400	5,477	6,000
West Virginia	489,325	525,400	429,580	462,500	55,205	57,900	1,851	2,000	2,639	3,000
North Carolina	960,359	1,069,200	859,900	962,300	87,739	95,300	7,940	8,300	2,950	3,300
South Carolina	441,000	490,200	386,290	432,300	49,520	52,600	4,115	4,300	895	1,000
Georgia	761,270	826,300	673,441	733,800	85,198	89,700	1,609	1,700	1,022	1,100
Florida	779,646	858,200	677,913	739,100	105,398	110,700	2,985	4,800	3,350	3,600
East South Central	2,518,803	2,739,100	2,250,197	2,460,700	244,811	253,000	10,426	10,800	13,369	14,600
Kentucky	661,376	722,400	583,810	643,700	69,898	70,700	3,212	3,100	4,436	4,900
Tennessee	770,505	832,500	687,220	746,000	75,248	77,700	2,149	2,300	5,888	6,500
Alabama	674,500	732,100	615,091	665,800	59,075	62,300	2,814	3,000	1,520	1,600
Mississippi	412,422	452,100	368,056	405,800	40,590	42,300	2,251	2,400	1,525	1,600
West South Central	3,520,054	3,920,600	3,153,137	3,428,400	424,137	444,600	28,416	31,800	14,364	15,800
Arkansas	432,681	469,700	386,119	421,000	43,212	45,200	2,410	2,500	940	1,000
Louisiana	620,393	673,700	539,498	588,800	74,153	77,100	4,457	5,300	2,285	2,500
Oklahoma	593,785	646,200	515,427	565,200	69,699	71,700	5,909	6,200	2,750	3,100
Texas	1,973,195	2,131,000	1,712,093	1,853,500	237,073	250,600	15,640	17,800	8,389	9,200
Mountain	1,404,257	1,496,300	1,211,311	1,294,900	173,650	181,000	15,291	15,900	4,005	4,500
Montana	173,076	182,800	148,594	157,300	21,449	22,100	2,537	2,700	496	500
Idaho	188,701	197,200	163,030	170,300	24,728	25,800	680	800	283	300
Wyoming	75,731	83,200	65,366	71,800	8,806	9,700	1,460	1,500	149	200
Colorado	380,883	404,100	323,310	344,800	47,758	49,100	8,402	8,600	1,413	1,600
New Mexico	149,489	174,400	129,039	152,800	19,318	20,300	612	700	520	600
Arizona	196,285	202,900	169,615	175,000	26,090	27,300	217	100	363	500
Utah	193,415	201,300	174,164	181,400	17,242	17,800	1,346	1,400	663	700
Nevada	46,677	50,400	38,213	41,300	8,259	8,900	87	100	118	100
Pacific	4,683,803	4,937,100	3,991,145	4,178,600	633,019	694,500	39,616	42,300	20,023	21,700
Washington	730,805	762,600	646,312	675,600	79,898	82,300	2,821	2,900	1,774	1,800
Oregon	482,932	504,200	415,421	434,700	61,698	63,900	3,360	3,000	2,453	2,600
California	3,470,066	3,670,300	2,929,412	3,068,300	491,423	548,300	33,435	36,400	15,796	17,300

Source: Edison Electric Institute.
* Estimated to December 31, 1950. Includes Street and Highway Lighting, Other Public Authorities, Railways and Railroads and Interdepartmental.

which is in second place, the cause is primarily new housing.

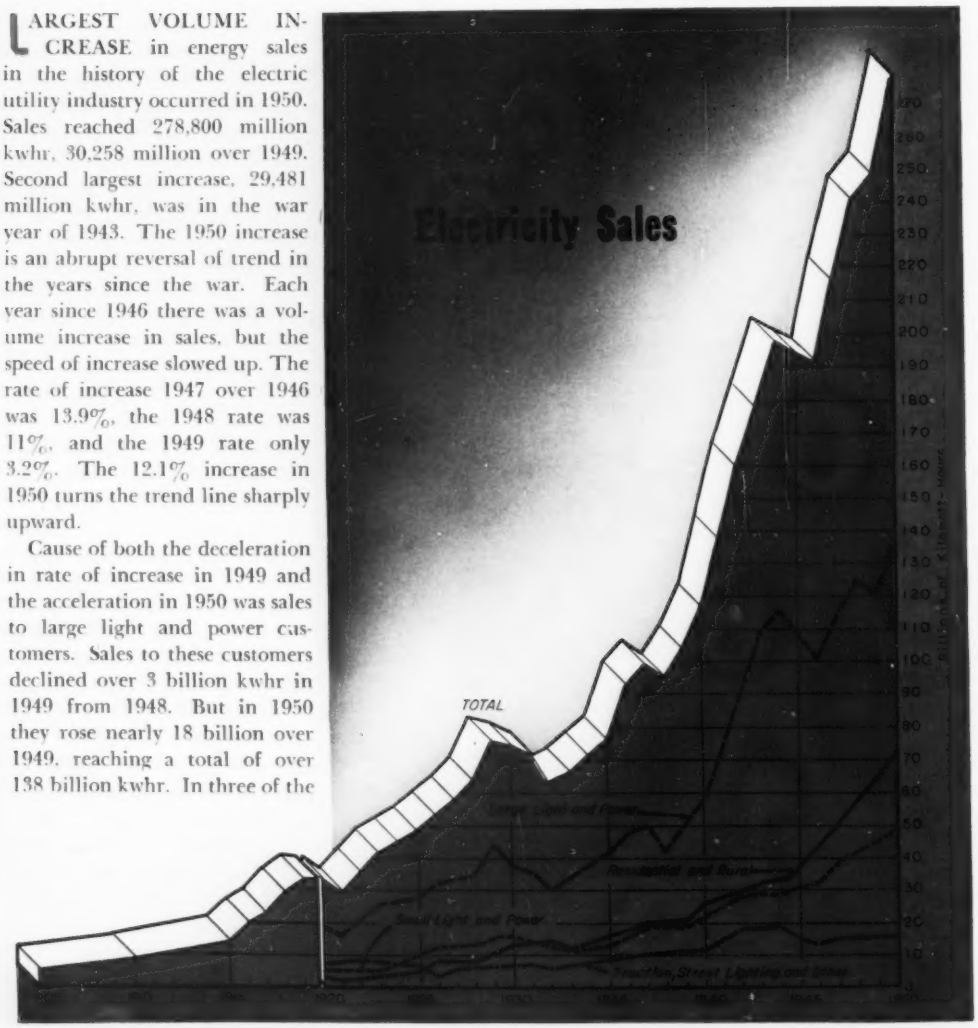
The Pacific region, which is sixth place in total and seventh in rural and residential customer increase, shows a 61,481 gain in small light and power customers. Some 35,000 of this growth were transfers from rural on the PG & E system. Apparently the gain of 3,000 in large light and power for California is representative of industrial growth in that territory. However, the loss of 3,500 large light and power customers in Ohio is due to a transfer of 4,000 large light and power customers to rural in the Cincinnati area. From a country-wide point of view it appears that consolidations of industrials along with some plant movements are causing decreases in total industrial customers in some of the older industrial areas, but large increases are shown in the South and West.

New Record Is Established

Industrial usage rises sharply to reverse the post-war trend of a declining rate of increase

LARGEST VOLUME INCREASE in energy sales in the history of the electric utility industry occurred in 1950. Sales reached 278,800 million kwhr, 30,258 million over 1949. Second largest increase, 29,481 million kwhr, was in the war year of 1943. The 1950 increase is an abrupt reversal of trend in the years since the war. Each year since 1946 there was a volume increase in sales, but the speed of increase slowed up. The rate of increase 1947 over 1946 was 13.9%, the 1948 rate was 11%, and the 1949 rate only 3.2%. The 12.1% increase in 1950 turns the trend line sharply upward.

Cause of both the deceleration in rate of increase in 1949 and the acceleration in 1950 was sales to large light and power customers. Sales to these customers declined over 3 billion kwhr in 1949 from 1948. But in 1950 they rose nearly 18 billion over 1949, reaching a total of over 138 billion kwhr. In three of the

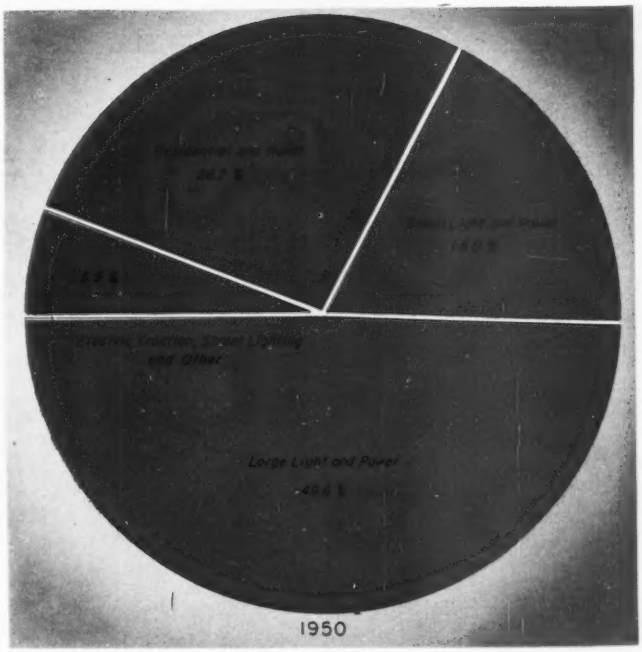


post-war years, 1946-1950, large light and power sales have been higher than in the highest war year. And the 1950 figure tops them all. It is spectacular evidence of the rapidly expanding use of electricity in American industry that the increase in this one year, even from a comparatively low point, should be about one sixth of the total usage for all-out production in a war year (1944) not too long ago.

The very small increase in sales of energy to rural customers is not to be taken as evidence that the farmers and other rural dwellers are increasing their use of electricity only in that degree. It is to be noted that the figures in this column of the accompanying table are of sales on distinct rural rates. The small 1950 increase results from the transfer of many of these customers to urban rates, a continuing practice among many electric utility companies.

Volume increase of sales to residential customers in 1950, 8.3 billion kwhr, compares with an increase in 1949 of 7.2 billion. Percentage-wise, the increases in the two years are about the same, 14% in 1949 and 14.3% in 1950. The increases in number of customers in the two years are also about the same, 5.5%, indicating that the use of electricity in the American home is maintaining or lifting its rate of increase.

Nearly 4 billion kwhr is the rise in sales to small light and power customers, the so-called commercial class. There were aboout 205,000 more of these customers in 1950 than in 1949. Since the average usage of these customers in 1950 was under 10,000 kwhr and the increase in sales divided by the increase in customers is about 20,000, it must be concluded that the average usage of these customers is still rising, although only slowly.



ENERGY SALES to large light and power customers were the highest on record. Sales to this group accounted for almost half of all electric energy sold in 1950

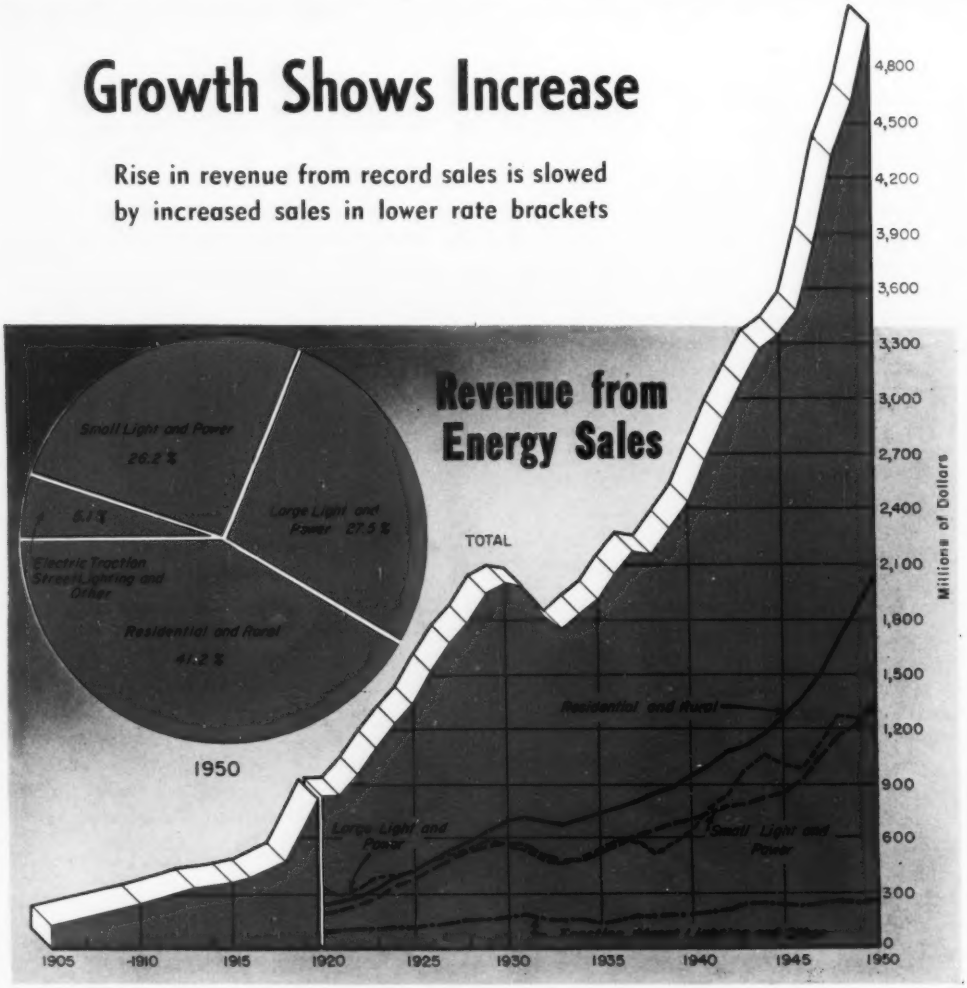
Use of energy in street and highway lighting rose about 200 million kwhr in 1949 over 1948, 250 million in 1950 over 1949. This acceleration in growth reflects the efforts now being made to awaken the public to the value of adequate lighting of the public ways. Sales for electric traction, urban and long distance transportation continued to decline for the fifth year.

Year	Rural*	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Other Public Authorities	Electric Traction	Interdepartmental	Total to Ultimate Consumers
1937..	1,670	17,691	18,075	51,360	1,863	2,403	5,712	586	99,359
1938..	1,577	19,371	19,137	43,140	1,929	2,451	5,438	688	93,731
1939..	1,881	21,084	20,722	51,108	2,002	2,538	5,765	667	105,768
1940..	1,991	23,318	22,373	59,557	2,048	2,720	5,909	727	118,643
1941..	2,352	25,124	24,628	76,060	2,111	3,093	6,078	614	140,060
1942..	2,890	26,937	27,234	88,378	2,061	4,206	6,628	1,074	159,408
1943..	2,996	28,621	28,192	106,657	2,075	9,139	7,226	983	185,889
1944..	3,373	31,266	29,837	115,187	2,163	8,463	7,329	543	198,161
1945..	3,668	34,184	30,438	107,490	2,184	7,589	7,354	650	193,558
1946..	4,431	38,571	33,016	98,885	2,272	5,854	7,147	619	190,794
1947..	5,551	44,171	38,379	113,523	2,365	5,916	7,104	571	217,581
1948..	6,327	50,978	43,193	124,088	2,525	6,255	6,720	654	240,740
1949..	7,384	58,139	46,262	120,766	2,726	6,583	6,112	570	248,542
1950**	7,450	66,450	50,050	138,350	2,975	7,075	5,850	600	278,800

Source: Edison Electric Institute. * Sales on distinct rural rates. ** Estimated.

Growth Shows Increase

Rise in revenue from record sales is slowed by increased sales in lower rate brackets

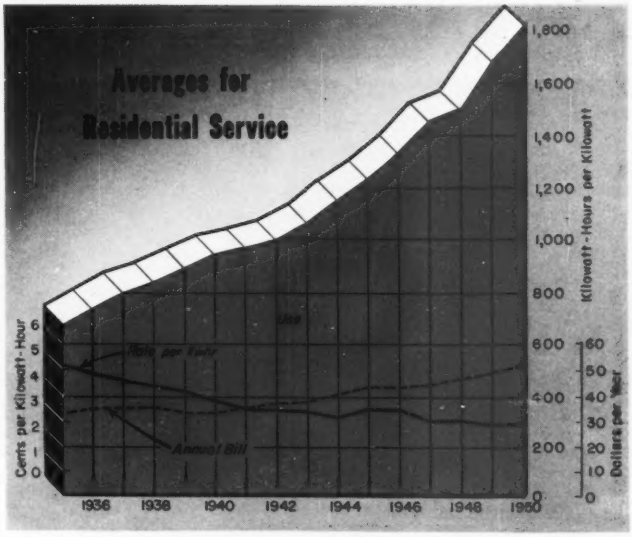


REVENUE from sales of electricity was up 9.2% in 1950 —$5,040 million as against $4,614 million in 1949. Parallel with this increase in revenue was a rise in sales from 249 billion kwhr to 279 billion, 12%. This greater proportionate rise in sales over revenue in 1950 contrasts with the condition in 1949 when the ratio rise in sales was only 3.3% as against 6.9% for revenue. This contrast clearly reflects the accelerated industrial activity of 1950 as compared with 1949. In that year energy sold to industrial customers was actually a little less than in the previous year. This reversal in industrial sales also explains the decline in average revenue per kwhr from 1.85¢ in 1949 to 1.8¢ in 1950.

Largest contribution to the $426 million increase in revenue came from residential customers, over 46% of it. Next come industrial customers with 29%. Despite the fact of their major contribution to total revenue increase, residential customers paid less per unit of energy in 1950 than ever before. Their average cost per kwhr was 2.88¢ as against 2.95¢ in 1949. Their average usage rose from 1,684 to

Year	Kwhr per Customer	Average Annual Bill (Dollars)	Rate per Kwhr (Cents)
1937	805	34.62	4.30
1938	853	35.31	4.14
1939	897	35.88	4.00
1940	952	36.56	3.84
1941	986	36.78	3.73
1942	1,012	37.51	3.67
1943	1,070	38.52	3.60
1944	1,151	40.40	3.51
1945	1,229	41.91	3.41
1946	1,329	42.79	3.22
1947	1,438	44.43	3.09
1948	1,563	47.05	3.01
1949	1,684	49.68	2.95
1950*	1,825	52.60	2.88

Source: Edison Electric Institute. *Estimated.



RESIDENTIAL USE of electrical energy rose to about 1,825 kwhr per customer. This increase of 141 kwhr over 1949 cost the customer about 2c per kwhr

1,825 kwhr, largest increase of any year on record. This increase of 141 kwhr caused a rise in average bill from $49.68 to $52.60. The increase in usage cost the average residential customer just over 2¢ per kwhr.

The decrease from 1949 to 1950 in the "Rural" column of the table is not to be taken as evidence of declining revenue from farm and other rural customers. The revenues in that column are from only those customers served on specific rural rates. Many power companies have "area" rates under which urban and rural dwellers are served without distinction. The number of companies with "area" rates is gradually increasing and, as the increase continues, revenue is transferred from the "rural" to the "residential" column. This is the explanation of the apparent 1949-1950 decrease in revenue from "rural" customers.

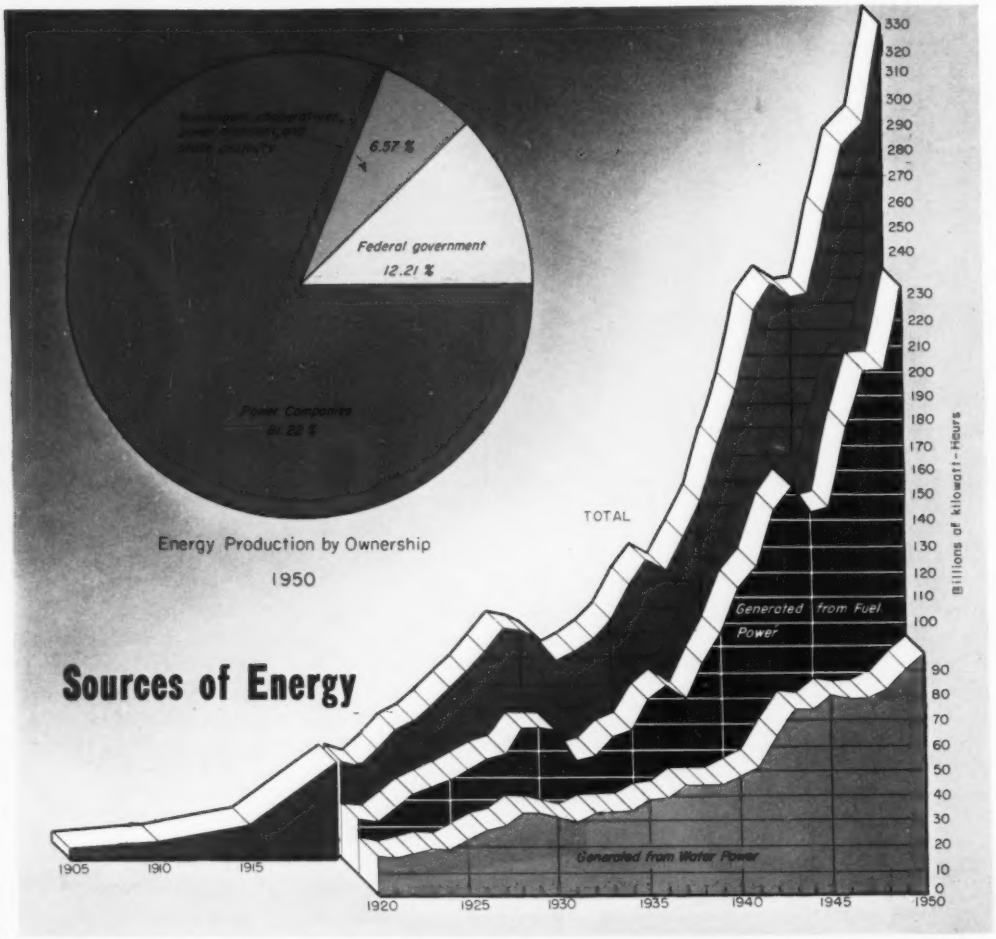
Again to be noted this year is the steadily increasing revenue from street and highway lighting. The upward trend started after the war. It appears to be becoming steeper, now having reached about a 10% annual rise from around 2% in 1946.

Revenue from Electricity Sales

Year	Rural*	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Other Public Authorities	Electric Traction	Inter-departmental	Total from Ultimate Consumers
1937	37,726	759,824	616,438	583,197	72,740	38,793	47,780	4,299	2,160,798
1938	38,928	802,532	632,091	518,694	74,323	40,195	45,507	4,311	2,156,580
1939	45,484	843,158	660,683	572,659	75,443	40,796	47,000	4,360	2,289,583
1940	49,473	895,951	689,253	631,428	76,052	45,515	47,808	4,737	2,440,218
1941	64,396	938,229	725,117	758,083	76,949	49,203	48,945	4,136	2,665,057
1942	75,027	990,185	767,279	828,318	75,660	60,206	53,632	5,536	2,885,843
1943	76,617	1,029,260	773,678	964,192	75,384	94,958	58,098	5,457	3,077,643
1944	82,842	1,097,726	817,355	1,043,392	76,626	94,452	60,274	4,085	3,276,752
1945	90,344	1,167,356	850,213	1,001,957	76,189	88,854	61,464	5,141	3,341,518
1946	104,876	1,240,577	924,775	969,348	77,570	77,047	60,288	5,078	3,459,560
1947	123,748	1,366,498	1,031,335	1,106,555	78,181	78,319	63,035	5,093	3,852,765
1948	140,648	1,532,663	1,152,783	1,250,684	82,391	84,890	63,551	5,712	4,313,313
1949	160,855	1,716,533	1,228,726	1,262,698	88,087	91,067	60,752	5,351	4,614,069
1950**	160,000	1,915,000	1,320,000	1,385,000	95,000	100,000	60,000	5,000	5,040,000

Source: Edison Electric Institute. * Distinct rural rates only. ** Estimated.

OUTPUT—329,028,000,000 Kwhr



Large Increase Over Previous Year

Upward trend of energy production is resumed after slowdown

OUTPUT of electricity for public use in this country rose from 291 billion kwhr in 1949 to 329 billion in 1950, an increase of over 13%. After the small increase of less than 3% in 1949, this is a big jump. Here can be seen the cumulative effects of weekly outputs which ranged as high as plus 20% over corresponding figures of the previous year and which included the industry's first 7-billion-kwhr week.

Accelerated industrial activity in 1950 was the principal cause of the greatly increased output although the contributions of other classes of elec-

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1935	56,915	38,372	95,287	901	5,669	90,519	12,923	77,596
1936	70,258	39,058	109,316	1,054	5,826	104,544	14,500	90,044
1937	74,900	44,013	118,913	1,733	6,428	114,218	14,859	99,359
1938	69,533	44,279	113,812	1,867	6,990	108,689	14,958	93,731
1939	84,078	43,564	127,642	1,900	7,734	121,808	16,040	105,768
1940	94,516	47,321	141,837	937	7,268	135,506	16,863	118,643
1941	113,925	50,863	164,788	927	6,335	159,380	19,320	140,060
1942	122,108	63,871	185,979	1,448	6,611	180,816	21,409	159,407
1943	144,127	73,632	217,759	1,537	9,729	209,567	24,678	185,889
1944	154,244	73,945	228,189	1,597	6,541	223,245	25,084	198,161
1945	142,516	79,970	222,486	1,773	3,368	220,891	27,333	193,558
1946	144,772	78,406	223,178	1,666	4,576	220,268	29,474	190,794
1947	177,314	78,425	255,739	1,269	6,186	250,822	33,241	217,581
1948	200,228	82,470	282,698	1,113	6,368	277,443	36,703	240,740
1949	201,351	89,748	291,099	1,004	5,887	286,216	37,675	248,542
1950*	233,596	95,432	329,028	1,200	8,853	321,375	42,575	278,800

Sources: Federal Power Commission and Edison Electric Institute. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. *Estimated.

tricity users were not negligible by any means. Nearly 25% of the 1950 output increase of 38 billion kwhr over 1949 came from the East North Central region comprised of Ohio, Indiana, Illinois, Michigan, and Wisconsin.

As between fuel and hydro production, the output in 1950 shows no large change from 1949. Fuel accounted for 69% of the total in 1949 and for 71% in 1950. This small increase in the fuel power proportion is reflected in the corresponding slight increase in the percentage of the power companies' contribution to the total, up from 80% in 1949 to 81% in 1950. The reason for this parallelism is the fact of preponderant ownership of fuel power generating capacity by the power companies.

Year	Power Companies	Local†	Federal	Total Local and Federal
1936	102,293	5,951	1,072	7,023
1937	110,464	6,606	1,843	8,449
1938	104,090	6,693	3,029	9,722
1939	115,078	7,088	5,476	12,564
1940	125,411	7,842‡	8,584	16,426
1941	144,290	9,705	10,794	20,498
1942	158,052	11,034	16,893	27,928
1943	180,247	13,027	24,484	37,511
1944	185,850	13,473	28,866	42,339
1945	180,926	13,559	28,001	41,560
1946	181,020	15,198	26,960	42,158
1947	208,105	17,757	29,877	47,634
1948	228,231	19,094	35,373	54,467
1949	233,112	19,885	38,102	57,987
1950*	267,227	21,615	40,186	61,801

Source: Federal Power Commission.
*Estimated. †Includes municipals, cooperatives, power districts and state projects. ‡1940 and following data revised to exclude production by publicly owned transit systems.

Region	1947			1948			1949			1950*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	13,346	3,507	9,838	14,341	3,026	11,315	14,275	3,218	11,057	16,249	3,550	12,699
Mid. Atlantic	53,201	9,658	43,543	57,432	9,064	48,368	56,933	9,038	47,895	63,359	9,880	53,479
E. No. Central	58,879	3,115	55,764	65,141	2,498	62,643	66,253	2,748	63,504	75,235	3,386	71,849
W. No. Central	15,033	2,639	12,394	16,250	2,312	13,939	17,486	2,833	14,653	19,147	2,926	16,221
So. Atlantic	32,266	8,271	23,995	36,089	9,326	26,763	36,973	11,044	25,929	43,511	9,336	34,175
E. So. Central	18,673	12,386	6,287	21,242	13,011	8,231	21,824	16,097	5,727	24,317	15,658	8,659
W. So. Central	15,340	1,151	14,190	17,794	1,022	16,771	19,429	1,350	18,080	22,747	1,419	21,328
Mountain	12,881	10,298	2,583	14,808	11,661	3,147	15,444	12,012	3,432	16,538	12,533	4,005
Pacific	36,120	27,402	8,718	39,601	30,550	9,051	42,483	31,409	11,074	47,925	36,744	11,181
United States	255,739	78,427	177,313	282,698	82,470	200,228	291,099	89,748	201,351	329,028	95,432	233,596

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. *Estimated.

CAPACITY—69,174,000 Kw

Generating Capacity by Regions

Region	1947			1948			1949			1950*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	3,377	894	2,483	3,566	922	2,644	3,890	932	2,958	3,965	933	3,032
Mid. Atlantic	10,906	1,584	9,321	11,742	1,590	10,152	12,624	1,611	11,013	13,039	1,602	11,437
E. No. Central	12,081	741	11,341	12,864	742	12,122	14,588	763	13,824	15,614	825	14,789
W. No. Central	3,669	562	3,107	3,978	564	3,414	4,556	575	3,982	4,915	578	4,337
So. Atlantic	6,784	2,221	4,563	7,288	2,221	5,067	7,988	2,218	5,770	8,727	2,297	6,430
E. So. Central	3,561	2,221	1,339	3,741	2,335	1,406	4,171	2,562	1,609	4,419	2,676	1,743
W. So. Central	2,994	385	2,609	3,358	385	2,973	4,005	420	3,585	4,546	464	4,082
Mountain	2,711	2,021	690	2,852	2,051	801	3,150	2,197	953	3,354	2,264	1,090
Pacific	6,239	4,341	1,898	7,171	4,842	2,329	8,130	5,376	2,753	8,930	5,923	3,007
United States	52,322	14,970	37,351	56,560	15,652	40,908	63,100	16,654	46,446	67,509	17,562	49,947

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. *Data to November 1.

Installed Capacity

Year	Type of Prime Mover		
	Fuel	Water	Total
1936	25,045	10,037	35,082
1937	25,444	10,176	35,620
1938	26,835	10,657	37,492
1939	27,859	11,004	38,863
1940	28,703	11,224	39,927
1941	30,588	11,817	42,405
1942	32,211	12,842	45,053
1943	34,067	13,884	47,951
1944	34,603	14,586	49,189
1945	35,199	14,912	50,111
1946	35,468	14,849	50,317
1947	37,351	14,971	52,322
1948	40,908	15,652	56,560
1949	46,446	16,654	63,100
1950*	49,947	17,562	67,509

Source: Federal Power Commission. *Data to November 1. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classifications.

Generating Capacity by Ownership

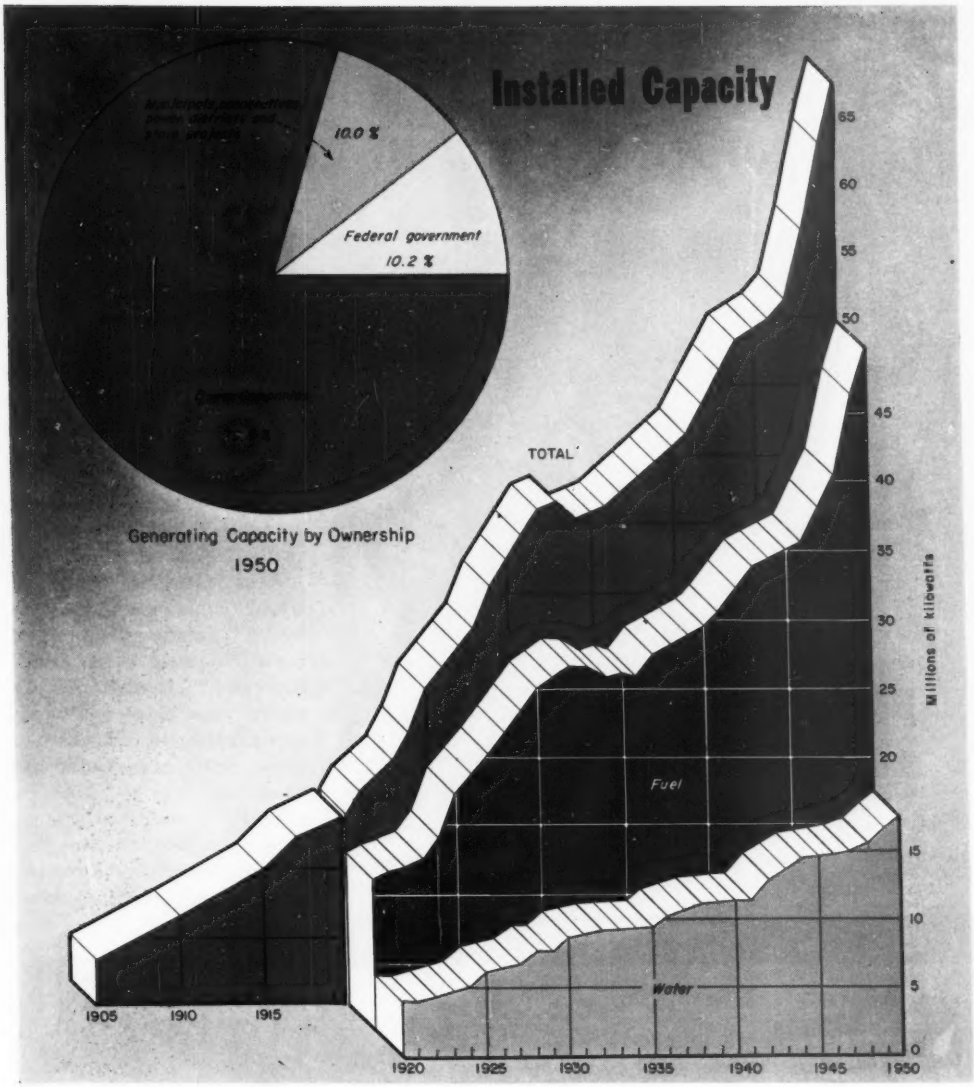
Year	Power Companies	Local†	Federal	Total Local and Federal
1936	31,787	2,491	804	3,295
1937	31,958	2,829	833	3,662
1938	33,246	3,090	1,156	4,246
1939	33,908	3,304	1,650	4,955
1940	34,399	3,584‡	1,944	5,528
1941	36,041	3,933	2,371	6,364
1942	37,442	4,395	3,216	7,611
1943	39,128	4,501	4,322	8,823
1944	39,733	4,570	4,886	9,456
1945	40,307	4,723	5,081	9,804
1946	40,335	5,063	4,920	9,983
1947	41,986	5,308	5,027	10,335
1948	45,381	5,654	5,525	11,179
1949	50,484	6,406	6,210	12,616
1950*	53,892	6,754	6,863	13,617

Source: Federal Power Commission. *Data to November 1. †Includes municipals, cooperatives, power districts and state projects. ‡1940 and following figures revised to exclude publicly owned transit capacity.

Increase In Capacity Continues

Installation of new machines is pushed rapidly to bolster decreased margin of reserve

AT THE END of 1950, an estimated 69,174,000 kw of generating capacity for public supply of electricity was at work in this country. The capacity as reported by FPC for November 1, 1950 was 67,509,000 kw. Close to 80% of the capacity installed in 1950 was in power company plants

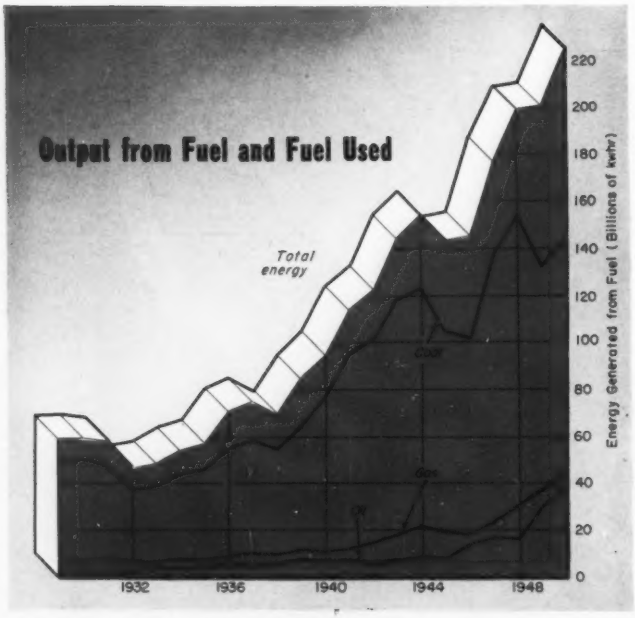


At High Post-war Rate

and nearly 85% of it was fuel-power capacity. Of the 20% non-power-company capacity, about half is in federal projects. Capacity of the electric cooperatives is a significant proportion of the remaining 10%.

Regionally, the largest addition to generating capacity in the first 10 months of 1950 occurred in the East North Central with 1,026,000 kw. Next came the Pacific region with 800,000 kw, and the South Atlantic close behind with 739,000. Fourth place was taken by the West South Central region with 541,000 kw.

Sharp Reduction in Coal Rate



OUTPUT FROM COAL rose 11.6 billion kwhr because of the great demand for power. Outputs from gas and oil continued to show substantial increases

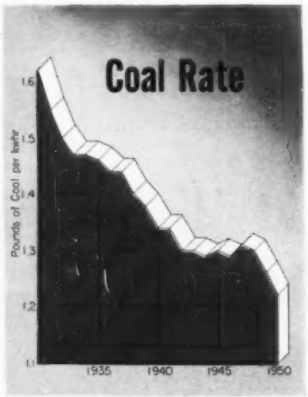
LARGE INCREMENTS of new generating capacity in conjunction with a record year of hydro generation enabled 1950 to be the best year ever for economy in use of fuel for generation. It now is taking only 1.22 lb of coal (or equivalent in gas or oil) to produce a kilowatt-hour. Until 1949 dropped the figure to 1.26 it had hovered around 1.30 lb for the last seven years.

A 16% increase in fuel generated output was accompanied by a 6% increase in hydro generation to make an overall increase of 13% in generation. Demands were so great that the disposition of the industry to decrease the use of coal in favor of other fuels was set aside and some 4½% more coal was consumed than in 1949.

There was an increase of 18% in use of oil and a 13% rise in

Year	Energy Generated From Fuel† (Millions of Kwhr)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl)	Gas (Billions of Cu Ft)	Coal Equiv.†† (Millions of Tons)	Pounds of Coal per Kwhr†
1938.....	69,225	38.39	12.94	165.50	48.56	1.40
1939.....	83,628	44.54	17.14	188.88	57.60	1.38
1940.....	93,963	51.47	16.33	180.10	62.94	1.34
1941.....	113,272	62.67	20.08	201.76	75.70	1.34
1942.....	121,585	66.26	15.24	235.21	79.08	1.30
1943.....	143,785	77.30	17.99	301.94	93.27	1.30
1944.....	153,868	80.08	20.86	358.78	99.25	1.29
1945.....	142,331	74.72	20.23	326.21	92.64	1.30
1946.....	144,555	72.20	36.32	306.94	93.47	1.29
1947.....	176,983	89.53	45.31	373.05	115.67	1.31
1948.....	199,796	99.59	42.64	478.10	130.12	1.30
1949.....	200,965	83.96	66.30	550.12	127.06	1.26
1950*.....	226,027	87.94	78.11	622.57	137.61	1.22

Source: Federal Power Commission. * Twelve months ended October 31.
† Output by use of wood not included, except for small amount in 1950. †† Coal plus oil plus gas.



POUNDS OF COAL required to produce one kwhr dropped to 1.22 in 1950

consumption of natural gas. As a result about 37% of the nation's generation is now based on other fuel than coal; 10 years ago the other fuels represented only 12% of the total. Consumption of oil is now 4.8 times as much as it was 10 years ago and that of gas has more than tripled.

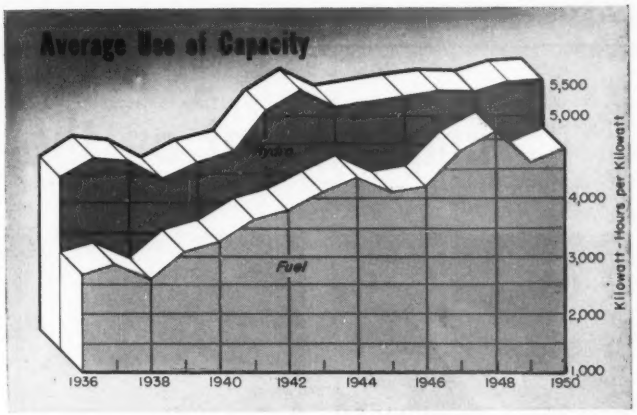
Highly significant is the fact that the consumption of our fuels for electricity generation is now at a rate practically 10% lower than it was a decade back. In 1940 it took 1.34 lb of coal to make a kilowatthour and now it takes only 1.22. All this is the result of two factors. One is that the efficiency of generation has been stepped up by resort to improved equipment, superior heat cycles and better operation.

The call for kilowatthours was reflected in more hours of operation of fuel-generation capacity than in any year except 1946 and 1947 when the war-created pinch was being relieved.

Generation from hydro was the greatest ever, with an increase of 7½% in output and of 5½% in capacity. The average hours of operation of hydro rose to a figure of 5,578 hr. This was slightly larger than 1949 and surpassed any year on record. It signifies that every kilowatt of hydro capacity was, on the average, in service at nameplate rating for 64½% of the time.

Under moderate load growth the industry would undoubtedly have considered that the postwar buildup of reserve margins would warrant retiring some of the oldest generating equipment. A year ago one-half the turbogenerators were more than 20 years old, one-fourth more than 25 and one-eighth more than 30. Likewise two-thirds of the boilers were more than 20 years old, one-third more than 25 and one-seventh more than 30. To hold even to these patterns of service life would call for retirement annually of 2 to 3% of the existing capacity.

Actual retirements reported to the Federal Power Commission amounted to only 103,232 kw of capacity in the first 10 months of 1950. Assuming for the year a figure of 120,000, the percentage of the total (63,100,000 kw) at the beginning of the year was less than one sixth of one percent. Of the 10-month retirement of 103,232 kw the steam block was 84,688 kw (including one 20 Mw and one 40 Mw unit), the hydro was 6,198 kw and the internal combustion was 12,336 kw. These retirements mounted to slightly more than the 1949 retirements but the percentage was smaller because of the large increments of new capacity. As a result the industry is having to retain in service considerable generating equipment of relative inefficiency and undependability.

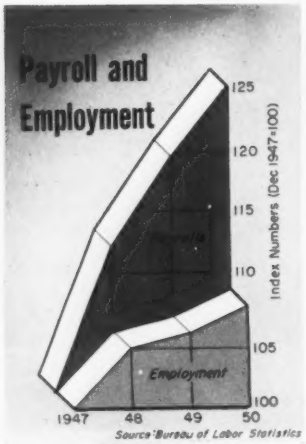


HYDRO GENERATION was the greatest ever. Average kilowatt of capacity produced at nameplate for 5,578 hr during the year, fed by a plentiful water supply

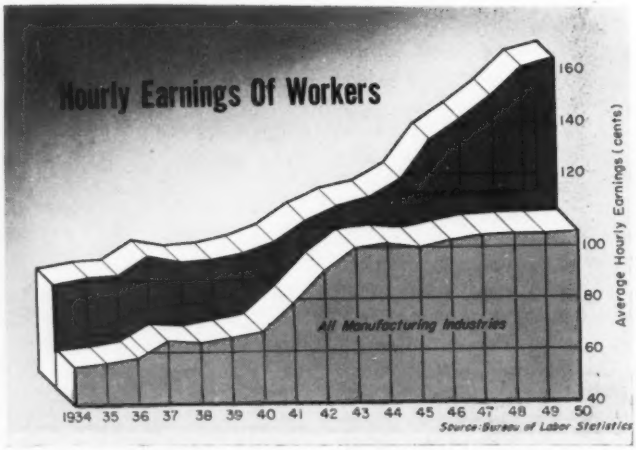
Year	Energy Generated (Millions of Kwhr)			Generating Capacity at end of year (Thousands of Kw)			Output per Kw Of Average Capacity (Kwhr)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1937...	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938...	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939...	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940...	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941...	116,908	51,262	168,170	31,828	12,264	44,092	3,784	4,284	3,923
1942...	125,002	64,179	189,181	33,381	13,025	46,407	3,834	5,076	4,181
1943...	147,027	73,943	220,970	35,237	14,068	49,305	4,285	5,458	4,617
1944...	156,704	74,032	230,736	35,671	14,604	50,275	4,392	5,164	4,634
1945*..	142,516	79,970	222,486	35,199	14,912	50,111	4,021	5,419	4,433
1946...	144,772	78,406	223,178	35,468	14,849	50,317	4,097	5,262	4,445
1947...	177,314	78,425	255,739	37,351	14,971	52,322	4,870	5,442	4,983
1948...	200,228	82,470	282,698	40,908	15,652	56,560	5,117	5,386	5,193
1949...	201,351	89,748	291,099	46,447	16,654	63,100	4,610	5,556	4,865
1950**.	233,596	95,432	329,028	49,947	17,562	67,509	4,847	5,578	5,038

Source: Federal Power Commission. *1945 and following data revised to exclude former Mining and Manufacturing and Railroad and Railway classifications. **Last two months in 1950 estimated.

Employment on the Increase



PAYROLL rose due to more employment, longer hours and higher wages



WAGES paid by power companies were higher than the average paid in all manufacturing industries, although power company wages rose less in 1950

More men working longer hours are required to meet the power demand

	Average Hourly Earnings (Cents)	Average Weekly Earnings (Dollars)	Average Weekly Hours	Estimated Number of Employees* (Thousands)
1934	79.1	30.35	38.5	.....
1935	80.5	32.10	40.0	.....
1936	81.9	33.00	40.7	.....
1937	87.3	34.94	40.1	.....
1938	86.1	34.33	40.0	.....
1939	87.1	34.64	39.7	.....
1940	90.4	35.37	39.1	.....
1941	94.0	37.73	40.3	.....
1942	102.2	41.94	40.8	.....
1943	107.8	46.48	42.9	.....
1944	111.9	48.84	43.3	.....
1945	118.6	50.49	42.0	.....
1946	133.7	54.58	41.4	.....
1947	141.5	59.71	42.2	219.0
1948	151.6	63.82	42.1	230.0
1949	161.2	67.38	41.8	232.7
1950	165.2	69.21	42.2	237.5

Source: Bureau of Labor Statistics. * Covers employees in the electrical divisions of privately owned power companies only. Data prior to 1947 not available.

THE RECORD of employment and hours worked in electric utilities reflects the bigger job done by the industry in 1950. Although greater power output was accomplished primarily through plant expanson and utilization, it also required more men working longer hours. Employment rose by 4,800 during the year, compared to an increase of only 2,700 in 1949.

The 1950 expansion of the utility labor force was part of a general rise in employment throughout the country. National unemployment dropped from 4.7 million in February to under 2 million by October. At the year-end, satisfactory workers were becoming hard to find in many areas. The number of labor market areas listed as "tight or balanced" by the Bureau of Labor Statistics had tripled.

Thus the new uptrend in utility employment coincided with the beginning of a national manpower shortage. For 1951, greater difficulty in obtaining new workers was clearly indicated. And much of the existing utility labor force was already working longer hours. In 1950 average weekly hours rose, for the first time since 1947. The

work-week in the industry averaged 42.2 hours, compared to 41.8 in 1949.

The combination of higher employment and longer hours resulted, of course, in a higher total payroll. Higher wages played a part too. But despite the size of some individual wage increases (see below), the industry's average wage did not rise very sharply in 1950.

Average hourly earnings in 1950 were $1.64, up less than 3¢ from 1949. This compares with annual increments of 10¢ in 1949 and 1948. The small gain was due to the relative stability of wages in the early part of 1950. In the second half, hourly earnings picked up faster.

Labor contracts signed by the electric utilities in 1950 varied widely in their provisions. Eleven companies granted wage boosts of 2 to 4¢. And 18 companies raised hourly wages by 6¢ or more. Of those who reported wage increases as a percentage of the previous wage, 11 companies settled for 2 to 4%. And 13 companies made 6% or greater increases.

The trend toward higher pensions and fringe benefits also continued. During the year, 15 new pension contracts were signed. And a number of existing pension plans were markedly improved. Twenty-eight companies granted other non-wage benefits.

An important factor in collective bargaining was the trend of the cost of living. The official Bureau of Labor Statistics index declined during the first two months of 1950, then began a slow rise which accelerated after hostilities began in the Pacific.

In this new atmosphere, some companies revised contracts agreed on early in 1950. Consolidated Edison, notably, provided for a 5¢ wage increase effective December 31, 1950, to be followed by an automatic increase of 5¢ more on July 1, 1951. Earlier in the year, Consolidated Edison had put into effect a substantial pension plan but its contract had provided for no straight wage increase.

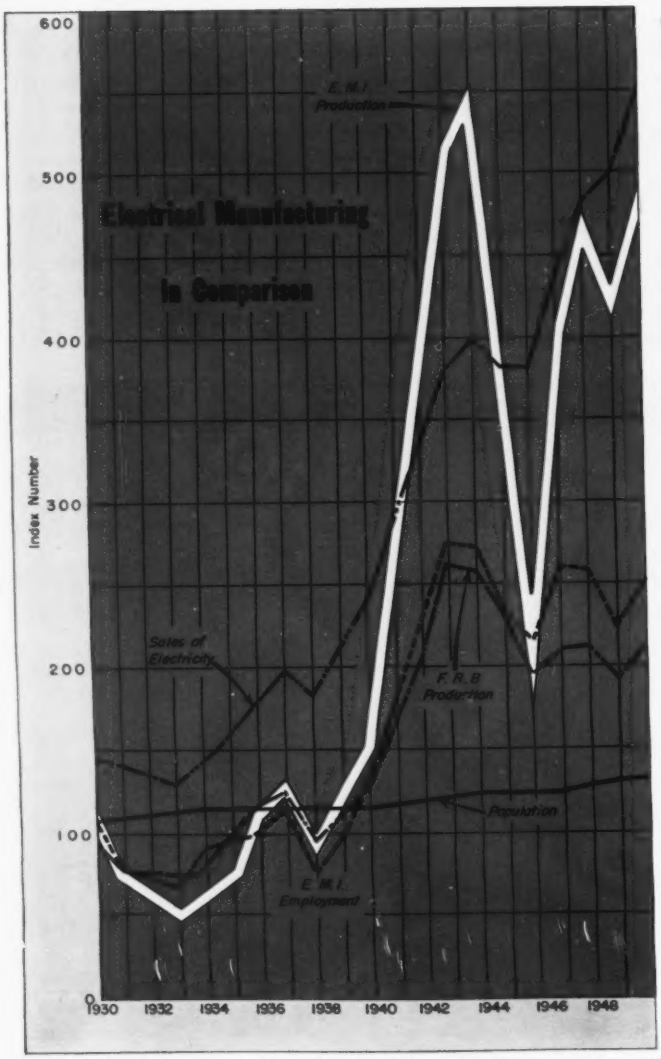
Despite such increases, average weekly earnings rose less in 1950 than did the cost-of-living index. For the postwar period as a whole, most utility workers were still considerably better off in terms of real income. But retail prices, particularly food prices, showed every sign of going considerably higher. This indicated pressure for more wage concessions in 1951.

Company	Union	Effective Date	Workers Covered	Wage Increase, Other Benefits
Narragansett Elec Co	Ind	1/ 1/50	1,700	2¢; pn, vc
Duke Power Co	IBEW	1/ 1/50	3,000	8.5%
Wisconsin Gas & Elec Co	UMW	1/ 1/50	250	4%
Bangor Hydro Elec Co	IBEW	.....	.....	4¢
Central Vermont Pub Ser	UMW	1/ 1/50	.....	5¢
New Bedford Gas & Ed Lgt	Ind	1/ 1/50	400	2¢
Con Edison and 3 Subs	UWU	1/ 1/50	30,000	(1); pro, pn
Puget Sound Pwr & Lgt	IBEW	1/ 1/50	1,800	5¢; vc, jd
17 Gas & Elec Co's (Mass)	Ind	1/ 1/50	1,500	2¢; pn
8 Pwr Co's (Boston)	UMW	1/ 1/50	600	2¢; pn, vc
Lynn Gas & Elec Co	UWM	2/17/50	550	sd, sl, vc
Metropolitan Edison Co	IBEW	3/ 1/50	1,100	5–12¢; hl, sl
Alabama Power Co	IBEW	3/ 1/50	3,000	7%
Columbus & So Ohio Elec	IBEW	3/ 1/50	900	3½; vc, dif
Birmingham Elec Co	IBEW	3/ 1/50	300	6% (av)
Georgia Power Co	IBEW	3/ 1/50	2,500	6 2/3%
Arizona Elec Co	IBEW	3/50	250	5¢ (2)
Central Arizona Pwr & Lgt	IBEW	3/50	800	ia
Staten Island Edison Co	IBEW	4/ 1/50	250	5–8¢; hw
New Jersey Pwr & Lgt	IBEW	4/ 1/50	400	4–10¢; hl, sl, dis
Appalachian Elec Co	IBEW	4/ 1/50	3,200	3¢; vc, hl, pn, li
Cincinnati Gas & Elec Co	.....	4/ 1/50	3,200	3¢; vc, hl, pn, li
Cincinnati Gas & Elec Co	IBEW	4/ 1/50	1,500	4–6¢; pn, vc
Consumers Power Co	UWU	4/50	3,700	6¢; sl, pn
Virginia Elec & Pwr Co	.....	4/ 1/50	2,575	5½¢ (av)
So Carolina Elec & Gas	IBEW	4/50	450	6½%; ra
Portland General Elec Co	IBEW	4/50	900	5¢
Central Illinois Pub Ser	IUOE	4/ 1/50	200	4–7%; vc (z)
Central Illinois Lgt Co	IBFO	4/ 1/50	200	6½¢ (av)
Public Service of Okla	IBEW	4/ 1/50	450	2%
Florida Light & Power Co	IBEW	4/30/50	1,800	6 2/3%
Ohio Power Co	.....	5/ 1/50	4,300	(1); pn, li
Washington Water Pwr Co	IBEW	5/ 1/50	600	$9 (mo)
Central Maine Pwr Co	IBEW	5/50	1,500	3¢ (hs, li, ac) (z)
Nor States Pwr Co (Minn)	IBEW	5/ 1/50	2,000	7¢ (av) 2.3¢; ia
Niagara Mohawk Pwr Corp	IBEW	6/ 1/50	7,500	4%; pn
Gulf States Utilities Co	Ind	6/50	400	2.5¢ (av)
Detroit Edison Co	UWU	6/ 1/49	4,500	4% (3)
Pacific Pwr & Lgt Co	IBEW	6/50	500	5¢
Cincinnati Gas & Elec Co	UMW	6/50	500	4–6¢; pn, vc
Rockland Lgt & Pwr Co	IBEW	6/ 1/50	200	5%
Iowa-Illinois Gas & Elec	IBEW	6/ 1/50	350	5%; vc (z)
Public Service of Colo	IBEW	6/ 1/50	1,600	5¢ (4); pn
Toledo Edison Co	OEIU	6/ 1/50	325	5¢
Niagara Mohawk Pwr Corp	IBEW	6/ 1/50	7,000	4%; (vc, pn) (z)
Scranton Electric Co	IBEW	6/ 1/50	500	4%(pn,vc) (z), fd
Potomac Elec Pwr Co	Ind	6/ 1/50	2,400	3–12¢ (6¢ av)
Ohio Public Service Co	IBEW	6/50	800	3¢; pn (z)
Connecticut Lgt & Pwr Co	IBEW	6/ 4/50	1,300	5%
East Shore Pub Ser of Md	IBEW	6/ 9/50	500	5–10¢; sl
Public Service of Ind	IBEW	6/30/50	3,000	5%
N Y State Elec & Gas	IBEW	7/ 1/50	2,000	8¢ (av)
Central Illinois Pub Ser	IBEW	7/50	250	6%; vc (z)
Michigan Northern Pwr Co	UMW	7/50	550	2¢; pn, hw
Union Electric Co	IUOE	7/ 1/50	1,250	10¢ (5); pn, ia
Union Electric Co	IBEW	7/ 1/50	1,000	6½%; hl (z), jd
Pennsylvania Pwr & Lgt	Ind	7/ 1/50	5,400	5%
Dallas Pwr & Lgt Co	IBEW	7/50	250	5%
Ohio Power Co	UWU	7/ 1/50	700	3¢; ia
Kansas City Pwr & Lgt Co	IBEW	7/ 1/50	2,000	7½¢; hl (z)
Cent Hudson Gas & Elec	IBEW	7/ 2/50	900	5%
Mississippi Pwr & Lgt	IBFW	7/12/50	400	7.1%
Sou Colorado Power Co	IBEW	8/50	200	4½%
San Diego Gas & Elec Co	IBEW	8/20/50	1,200	3½–4% (6); vc (z)
Omaha Pub Pwr Dist	.....	9/ 1/50	800	6–7½%
Metropolitan Util Dist	.....	9/ 1/50	900	9¢(hr)$15.30(mo)
Connecticut Pwr Co	IBEW	9/50	400	4%; aa
Ohio Edison Co	UWU	9/50	1,400	7½¢; (pn, vc) (z)
Pacific Gas & Elec Co	IBEW	9/ 1/50	22,000	3%(7)pn(z)wc,li
Detroit Edison Co	UWU	9/ 4/50	4,500	3%, pn (z)
Florida Power Corp	IBEW	9/26/50	700	6 2/3%
Pub Ser Elec & Gas Co	IBEW	10/ 1/50	4,300	6%(8)pn(z)sd,aa
United Illuminating Co	Ind	10/50	800	10¢; (pn, hp) (z)
Cleveland Elec Illum Co	UWU	10/ 2/50	4,300	3%
Atlantic City Elec Co	IBEW	10/25/50	1,150	5½¢
Indiana & Michigan Elec	UMW	11/ 1/50	450	10¢(li,hs) (z) pn
Empire District Elec Co	IBEW	11/ 1/50	300	8¢
Public Service Co of N H	.....	11/ 6/50	1,000	10¢
Virginia Elec & Pwr Co	UWU	12/50	4,500	6%
Consolidated Edison	UWU	12/31/50	27,000	5¢; ra, pro

Source: Bureau of Labor Statistics. Includes all contracts reported to BLS up to Dec. 26, 1950.
Wage Increase Notes: (1) See later contract; (2) 6c more in 1951; (3) ½% more in 1950; (4) 2.5c more in 1952; (5) 5c more in 1951; (6) 1.75% more in 1951; (7) 1% more in 1951; (8) 2% more in 1951.
Other Benefits. Notes: aa-arbitration award; ac-accident; dif-death in family leave; dis-disability; f-fringe; fd-five-day week for office employees; hl-holiday leave; hp-holiday pay; hs-hospitalization; hw-health and welfare; ia-inequity adjustment; jd-pay for jury duty; li-life insurance; pn-pension; pro-increased progression; ra-rate adjustment; sd-shift differential; sl-sick leave; vc-vacation; wc-improved working conditions; (z) benefit (or benefits) involved improved or additions made thereto.

Production Recovers Sharply

Production index rises as electrical appliances set new record

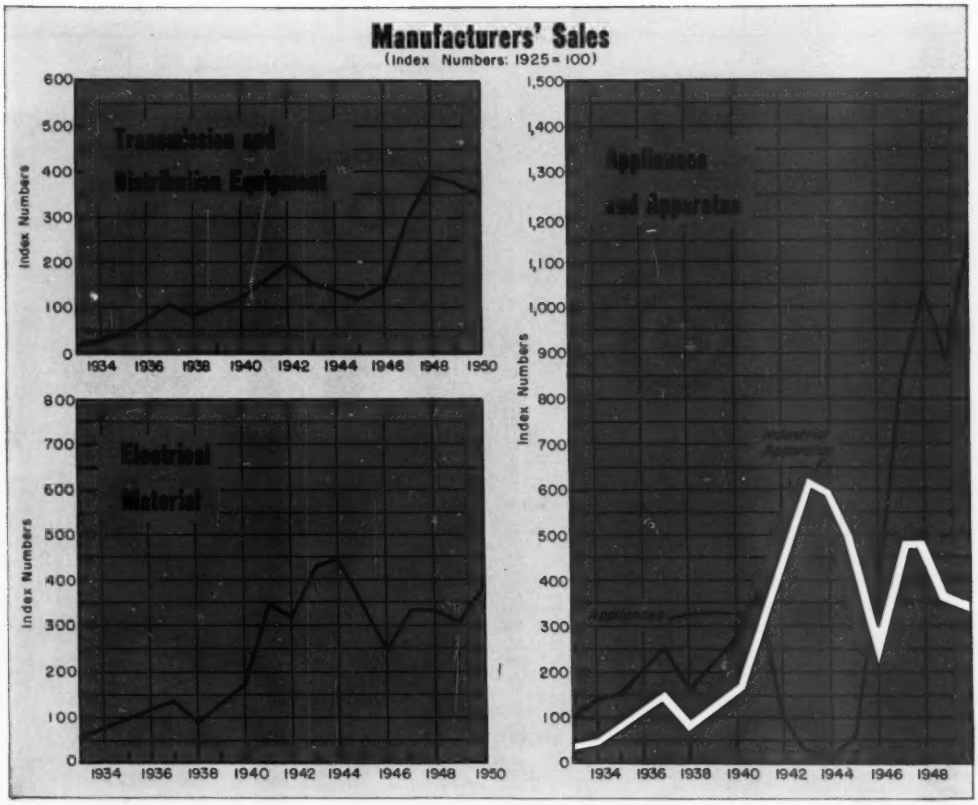


PRODUCTION in the electrical manufacturing industry in 1950 increased by 64 points to 493 on the strength of the record output of electrical appliances

THE electrical manufacturing industry made a rather spectacular recovery in 1950 from its decline in 1949, as is shown in the accompanying index tabulation. The index rose from 429 to 493. In terms of production of electrical goods the level of 1950 is the highest yet reached by the industry. The higher indexes of 1943 and 1944 reflect producton of war material, much of it not of electrical nature. The 1950 recovery of electrical manufacturing far outstripped that of all manufacturing as shown in the Federal Reserve Board index.

The cause of this difference is apparent in the large increase in the index of sales of electrical appliances. More information on this point is contained in the January, 1951, number of "Electrical Merchandising" which says that except for fans, Christmas tree lights, and coal stokers, every electrical appliance enjoyed a larger sale in 1950 than in 1949. Conspicuous in the "Electrical Merchandising" listing are electric ranges with sales up from 1,056,000 units to 1,830,000; water heaters, up from 695,000 to 990,000; food freezers, up from 485,000 to 890,000; refrigerators, up from 4,450,000 to 6,200,000.

The only index of electrical product sales that shows a 1950 decline is that of transmission and distribution apparatus.



YEAR	The Industry and Related Factors					Sales of Electrical Products			
	1 E.M.I. Production	2 E.M.I. Employment	3 F.R.B. Production	4 Sales of Electricity	5 Population	6 Appliances	7 Electrical Material	8 Industrial Apparatus	9 Trans. & Dist. Apparatus
1929	156	137	121	150	106	178	135	149	120
1939	123	98	120	212	114	229	116	127	104
1940	154	129	137	238	115	273	149	177	124
1941	276	189	178	281	116	376	253	317	189
1942	415	228	219	319	117	93	318	465	213
1943	522	282	263	372	119	27	447	638	167
1944	553	271	258	396	120	17	453	633	141
1945	390	228	223	387	122	73	343	455	138
1946	258	212	187	382	123	395	253	295	153
1947	415	262	205	435	125	867	339	495	309
1948	477	259	211	481	128	1040	339	482	399
1949	489	232	193	497	131	881	310	373	374
1950*	493	252	212	551	132	1156	399	469	352

Source: NEMA and McGraw-Hill Dept of Economics. *Estimated.

1. E.M.I. PRODUCTION reflects total production in the electrical manufacturing industry, which industry is considered to cover not only those products commonly referred to as Electrical Machinery, Apparatus and Supplies, but also all electric appliances including washing machines, vacuum cleaners, household refrigeration equipment, commercial refrigeration equipment, air conditioning equipment, lighting fixtures, insulating materials, radio apparatus and supplies, automotive electrical equipment, steam turbines for electrical drive, bare copper wire, and mining and industrial electric locomotives. Production of non-electrical equipment within the industry is also included for the war and post-war years.

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925=100. This series represents the electrical manufacturing industry including radio and includes latest revision to Census figures made by N.I.C.B. Recently, however, the N.I.C.B. Index was discontinued and therefore the figures since 1947 represent an extension of the 1947 figure based upon the B.L.S. Employment Index of Production Workers in the Electric Machinery Manufacturing Industry.

3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for total industrial production, unadjusted, and adjusted to 1925=100 (includes all revisions made by F.R.B. up to December 15, 1943.)

4. ELECTRIC POWER SALES index figures based upon E.E.I. data.

5. POPULATION based upon the annual mid-year estimates of the U. S. Bureau of the Census.

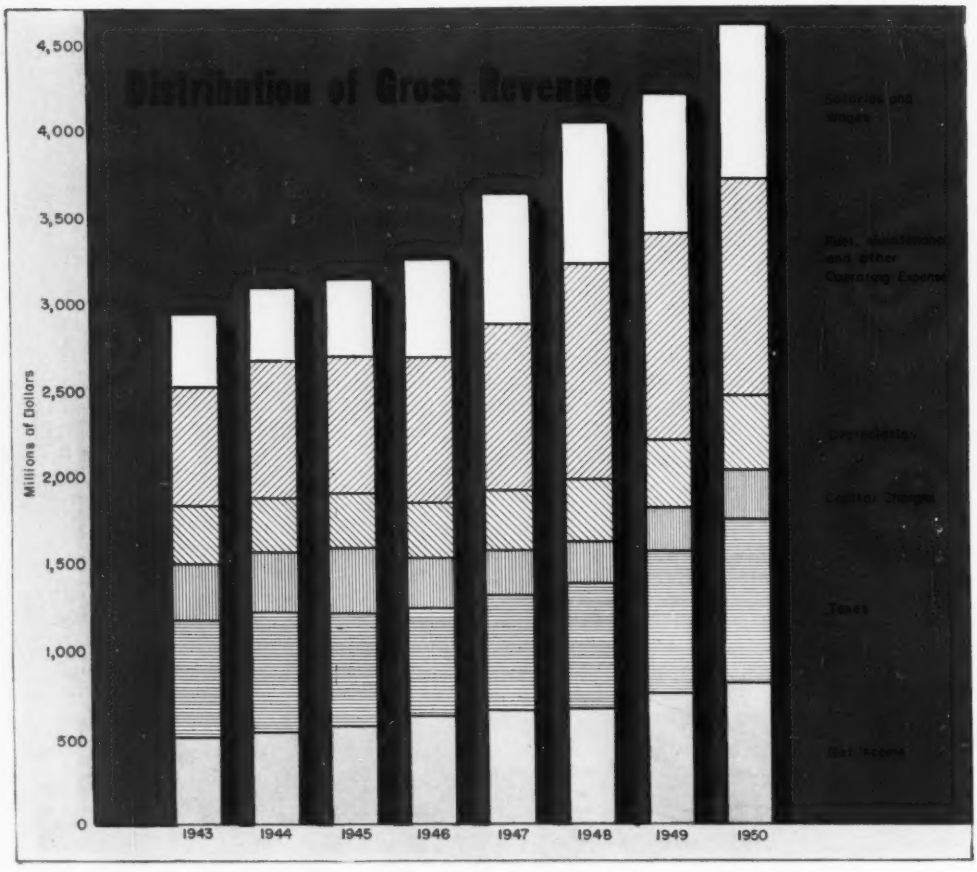
6. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans, food service equipment, and household refrigerators, complete units, parts and cabinets. All commercial refrigeration equipment and air-conditioning equipment are excluded.

7. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

8. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

9. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and watthour and demand meters.

All indexes based upon U. S. Census of Manufacturers data and NEMA statistical department data corrected where possible to represent the entire industry.



Net Income Continues to Rise

General business boom and controlled costs influence increase

UTILITY EARNINGS rose again in 1950. But the gain was not so spectacular as in 1949. The boom in general business set the stage for an impressive gain in revenues. And costs were fairly well controlled. Income before taxes was up 12% from 1949. But taxes rose even more sharply and reduced the gain in net income to 7.2%.

The experience of 1950 illustrates the difficulty of increasing profits in a war or near-war period. The industry sold 12% more kwhr than in 1949. But much of the increase was in sales to industrial consumers at low rates. So the gain in gross revenues was only 8.8%. This was more than enough to offset in-

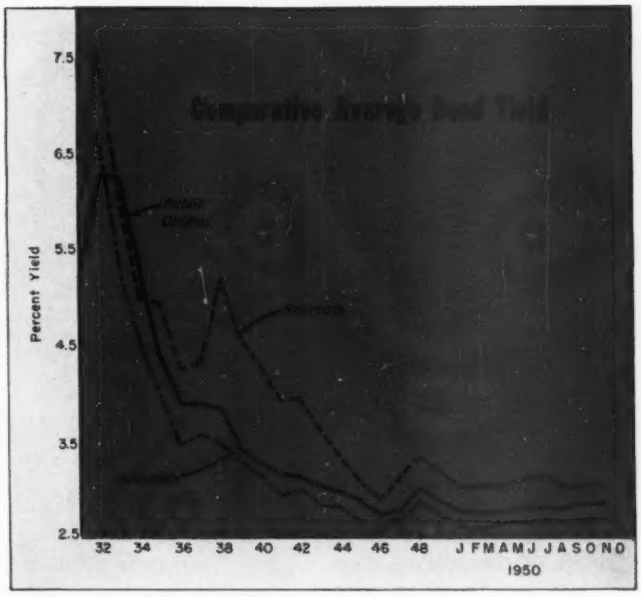
creased operating expenses. But it could not offset an 18% rise in taxes, resulting partly from the higher federal income tax rate made effective July 1.

Near-war conditions, of course, prevailed only in the second half of 1950. For this reason, the utilities' composite income statement does not fully reflect the higher costs and higher taxes which followed the outbreak of fighting in Korea. In the first half year, many costs were still declining. Coal prices, for example, were considerably lower than in 1949. And many power companies acquired inventories of construction materials and metal products at 1949 prices or slightly below. Even in the second half-year, prices of some items were governed by contracts made before Korea.

Consequently, total operating expenses for 1950 increased only 5.4%, compared with the 8.8% gain in gross revenues. The ratio of total operating expenses to total revenues was only 46%, the lowest since 1946. This was accomplished in spite of the fact that the industry added nearly 7% to its payrolls and paid fuel bills totalling 8.5% more than in 1949. Other operating expenses were actually reduced 2% during the year.

But the sharpest year-to-year change in the composite income statement was the rise in taxes. Federal income taxes alone increased by more than a fourth. State and local taxes also rose, mainly because of the higher value of utility plant subject to property taxes. Total taxes paid reached 20.3% of revenue.

The higher tax bill brought total revenue deductions to 9.4% more than in 1949. That left electric operating income only 6.7% ahead of the previous



AVERAGE YIELD of utility bonds rose slightly in 1950. In this is reflected the slightly lower amount of debt financing during the year than in 1949

	Millions of Dollars		
	1949	1948	1947
ASSETS:			
Electric Plant and Adjustments	17,326	15,513	14,065
Other Utility Plant and Adjustments	2,302	2,244	1,964*
Total Utility Plant	19,628	17,757	16,029
Reserves for Depreciation and Amortization of Utility Plant	4,069	3,859	3,572
Total Utility Plant Less Reserves	15,559	13,898	12,457
Investment and Fund Accounts	1,272	1,155	1,096
Current and Accrued Assets	1,899	1,985	1,786
Deferred Debits	176	227	257
Capital Stock Discount and Expenses	38	35	33
Reacquired Securities	57	46	57
Total Assets	19,001	17,346	15,686
LIABILITIES:			
Capital Stock	7,256	6,590	6,224
Long Term Debt	8,572	7,719	6,601
Current and Accrued Liabilities	1,359	1,360	1,203
Reserves (except those deducted above)	99	100	198
Deferred Credits	103	112	118
Contributions in Aid of Construction	60	154	49
Surplus	1,552	1,411	1,292
Total Liabilities	19,001	17,346	15,686

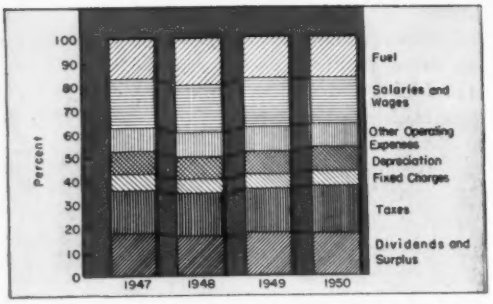
Source: Federal Power Commission.
* Data revised to include Gas Plant classification which was discontinued in 1948. All plant is now classified as "electric" or "other."

Distribution of Revenue Dollar

(Percentage)

	1947	1948	1949	1950*
Fuel	16.4	19.3	16.6	16.6
Salaries and Wages	20.6	20.4	20.3	19.9
Other Operating Expenses	10.2	10.6	10.9	9.8
Depreciation	9.4	9.1	9.2	9.5
Fixed Charges	6.8	6.1	6.3	6.1
Taxes	18.4	17.8	18.7	20.3
Dividends and Surplus	18.2	16.7	18.0	17.8
	100.0	100.0	100.0	100.0

Source: Federal Power Commission and Edison Electric Institute.
* Estimated.



TAXES took a larger share of the utility revenue dollar in 1950, leaving slightly less for salaries and wages for employees, dividends to stockholders and surplus

year, despite a pre-tax gain of 12%.

Non-operating income showed a significant gain. Particularly important in this regard were the rate increases won by gas divisions of the utilities. Combined income from the gas, water and steam departments ran $9 million ahead of 1949. Income on securities held dropped about $1 million. Total income available to stock and bond holders was up 6.6% from the year before.

Interest payments rose considerably less than dividend payments in 1950. New issues of preferred and common stock pushed the required dividend total up 11%. But new bond issues tapered off, so that interest requirements were only 5% higher. It is significant that, after interest and dividend payments, the industry had slightly less earnings left for re-investment than it did in 1949.

The composite balance sheet shows that the utilities began 1950 with about 10% more invested in plant than a year before. Outstanding capital stock and long-term debt were also about 10% higher. New money entering the business in 1950 was around 10% less than in 1949.

Composite Income Statement
Electric Light and Power Companies

(Millions of Dollars)

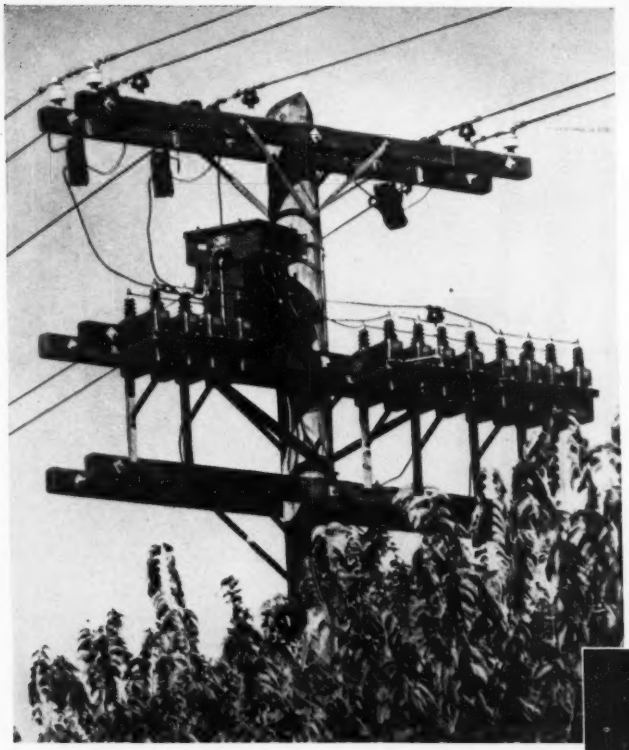
	1945	1946	1947	1948	1949	1950*
Total Electric Revenue	3,012	3,127	3,480	3,903	4,113	4,475
Operating Expenses	1,259	1,385	1,701	2,026	2,030	2,139
Depreciation	322	324	339	366	389	439
Total Expenses	1,581	1,709	2,040	2,392	2,419	2,578
Electric Operating Income before Taxes	1,431	1,418	1,440	1,511	1,694	1,897
Taxes	652	639	664	716	794	937
Electric Operating Income after Taxes	779	779	776	795	900	960
Other Income (1)	126	130	125	119	132	140
Gross Corporate Income	905	909	901	914	1,032	1,100
Capital Charges (2)	360	259	245	244	267	280
Net Income	545	650	656	670	765	820
Dividends	415	467	504	503	559	620
Surplus	130	183	152	167	206	200

Source: Federal Power Commission and Edison Electric Institute. * Estimated.
(1) Includes revenues of gas, water and steam departments and interest on securities held.
(2) Includes amortization and interest on long-term debt.

Security Sales by Classes

(In Thousands of Dollars)

Year	Bonds, Debentures, etc. to		Stocks, Common and pfd.	Total Financing	Distribution of Security Sales		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1936	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,253	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,039,517	153,159	384,699	1,577,375	567,729	1,009,646	1,577,375
1948	996,641	156,525	297,460	1,450,626	1,314,456	136,170	1,450,626
1949	959,978	192,280	640,953	1,793,211	1,444,826	348,385	1,793,211
1950	838,108	278,389	591,340	1,707,837	1,300,040	407,797	1,707,837

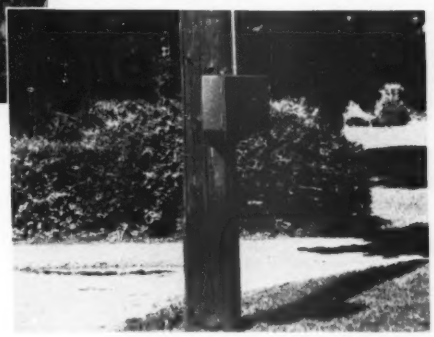


This is a current-controlled switched capacitor bank at Eastern and Sutherland Avenues in Indianapolis. An oil switch is mounted with the capacitors.

Capacitors profitable

at rate of 1 kvar for each 286 ft. of feeder

Indianapolis Power & Light Company raising power factor to near-unity by adding 180-kva pole-mounted capacitor banks, many of them with oil switches



An interesting feature of the Indianapolis installations is the method of controlling the many switched banks. Tests showed that kvar loading followed kva loading on practically all feeder circuits. Consequently a current relay, shown here, operated from a current transformer in the feeder, is used to control the oil switch installed with the capacitors on the next pole.

Indianapolis Power & Light Company is currently installing pole-mounted banks of General Electric capacitors out along their 4-kv feeders. At the end of their present program, they will have approximately 44,000 kvar in service—or one kvar for each 286 feet of overhead 4-kv line. This is in addition to capacitors installed on the 4-kv buses at some of the larger substations.

Here is another case of a utility that is getting more effective use from its distribution system—and consequently reducing invested cost per delivered kw-hr—by raising power factor to near-unity. Have you checked recently to see how much extra system capacity you have that can be released by installing G-E permanently connected *or switched* capacitors?

Apparatus Department, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

SPIRAKORE

is saving users millions

Back in 1937, General Electric introduced a brand-new idea in transformer construction—the wound-core—which made possible smaller, lighter transformers, 10 to 20 per cent lower in price.

Since then, General Electric's Spirakore* transformers have saved operators more than 30 million dollars in initial investment alone. Purchasers of other transformers have profited also, since every domestic builder of distribution transformers has adopted some modification of the wound-core construction.

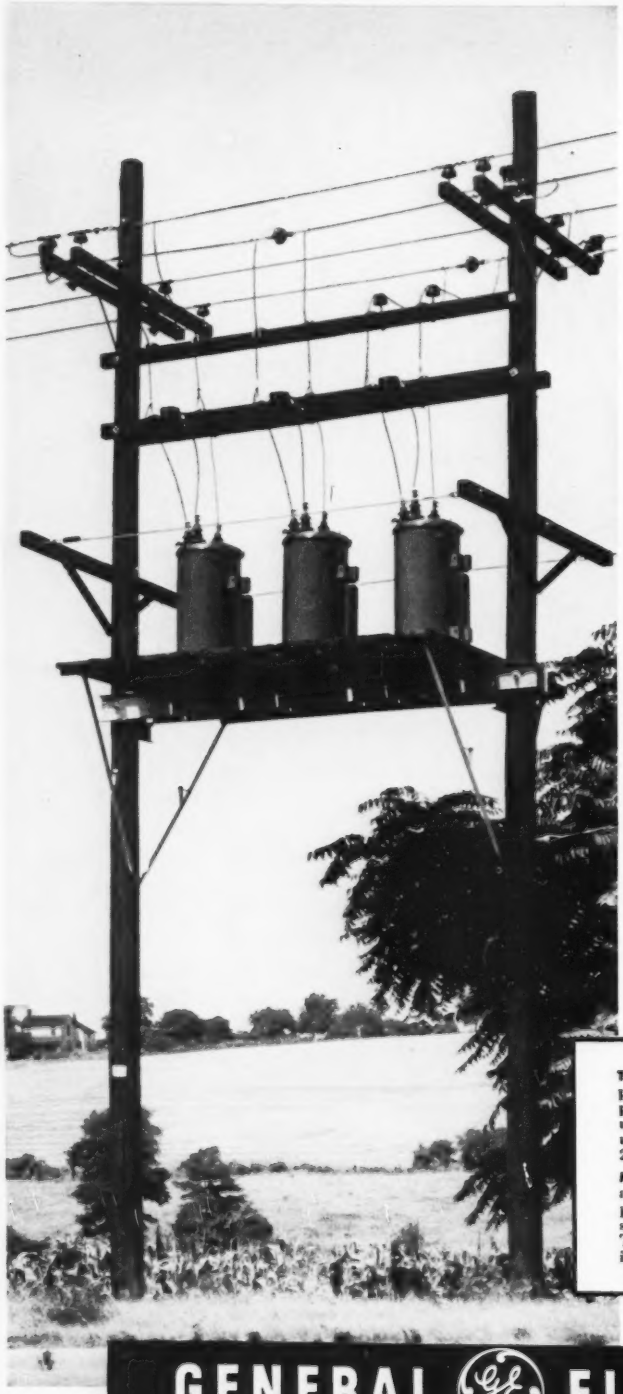
Today, General Electric builds all single-phase distribution transformers with Spirakore construction. The same combination of forward thinking, sound engineering, and skilled workmanship that produced the original Spirakore design has kept Spirakore ahead as the standard for others to try to equal. It's the finest transformer we have ever built—the finest you can buy.

We have just published this 32-page, full-color book on the Spirakore transformer. If you haven't already received your copy, get one from your local G-E representative, or write 402-102, Apparatus Dept., General Electric Company, Schenectady 5, New York.

* Registered trademark of the General Electric Co.

GENERAL ELECTRIC

402-102



Voltage regulation costs less than new copper

The simplest, least expensive way to keep voltages up for rural customers is by using voltage regulators out along the feeders, without adding new copper. Supplementary regulation maintains proper voltage regardless of load. Revenue goes up; complaints go down.

General Electric's ML-8 is a service-proved regulator built specifically for rural lines. It provides 10% automatic voltage regulation, in eight 1¼% steps. It brings you complete reliability, minimum maintenance—*at the lowest price for any regulator.*

Booklet GEA-5417 gives full information. Ask your local G-E office for a copy, or write to *Apparatus Dept., General Electric Co., Schenectady 5, New York.*

THREE ML-8 VOLTAGE REGULATORS shown in platform installation. Suitable for either pole or platform mounting, ML-8's can be used for circuits up to 7960 volts carrying up to 100 load amperes (to 150 amperes on 2400-volt circuits).

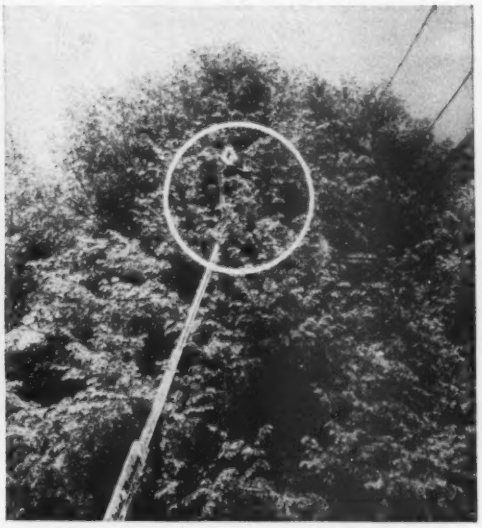
ML-8 FEATURES include a shockless, snap-action Geneva-gear drive for positive positioning of contacts, and an improved switching circuit using a bridging reactor. The switching mechanism and its operating motor are completely immersed in oil.

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Boom and Cage Cut Tree Trimming Costs 40%

BOOM AND CAGE mounted on a standard 1½-ton truck have over-all height of about 10½ ft in travelling position. To operate pneumatic tools, 200-psi compressors are carried on truck



TREE TRIMMING and street light maintenance costs have been cut by use of self-leveling cage (circle). Unit costs about $4,400 installed and is expected to save $50,000 its first year

S. J. PEARSON
Supt, Outside Divisions
Portland General Electric Co

Savings of 40% on tree trimming costs and 50% on street light maintenance have been realized by Portland General Electric with a truck-mounted boom unit. The device is a hydraulic piston with a self-leveling cage at the end, capable of reaching a maximum height of 33 ft.

Cage is controlled by three pairs of foot switches which raise, rotate and extend it to cover about 1,200 sq ft without moving the truck. Hydraulic power is supplied from a power takeoff connected to the truck transmission. Dual controls in the truck cab and a safety switch on the cage to shut off all power give maximum flexibility and safety.

The company has equipped the truck with an air compressor to operate pneumatic pruning tools. In anticipation of further tool development and use of pneumatic drills for wood and steel, new units are being equipped with 200-psi, 30-cu ft compressors.

In addition to street light maintenance and tree trimming, the unit has been used for mid-span work, reinsulating, wire stringing and many other jobs. Cost of unit is about $4,200 fob Portland, installation is about $200.

Compact Meter Test Kit Has Eight Load Circuits

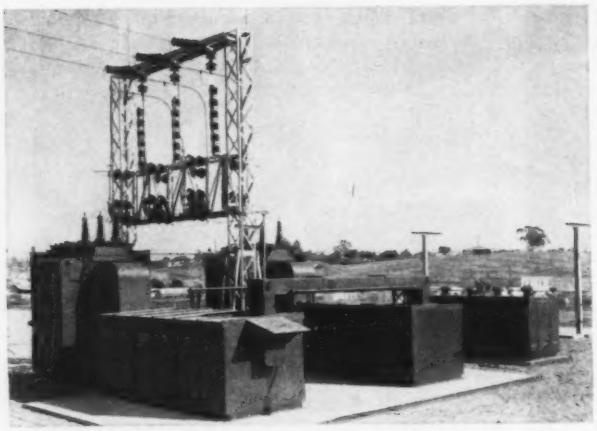
R. W. PFAFF, Meter Division
Philadelphia Electric Co

Philadelphia Electric Company's meter division was in need of a light, rugged resistance-type meter test kit that would be safe and simple to operate, but require little maintenance. These specifications are fulfilled by a company-built test kit weighing about 32 lb, complete with accessories. (Advantages of resistance loading are given in "Proper Loading of Meters for Rapid Field Testing," in Electrical World, page 131, Oct. 23, 1950.)

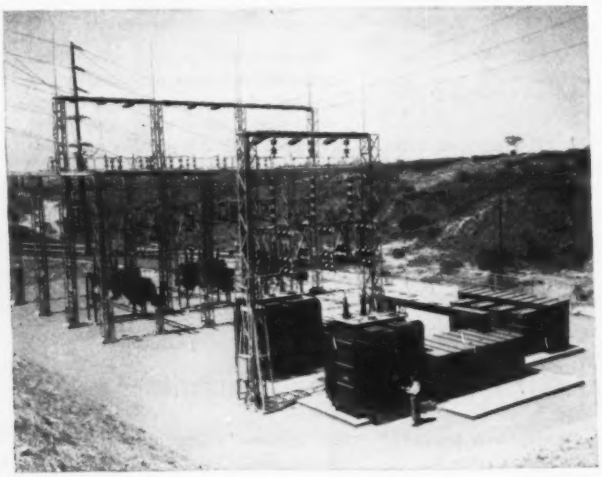
The load box consists of two split circuit units, each of 0.5 and 1-amp

(*Continued on page* 158)

SAN DIEGO GAS AND ELECTRIC
speeds expansion with
PACKAGE SUBSTATIONS



CHOLLAS PACKAGE SUBSTATION, rated 12,000/16,000 kva. Photograph taken from near 69-kv structure shows metal-clad switchgear, 69-kv mounting arresters and horngap switches, and the 125-volt battery house.



WABASH SUBSTATION—constructed completely from packaged equipment, including station structure. This station transforms 69-kv to 4160 volts. Equipment includes two unit substation transformers 5000-kva self-cooled or 6667-kva forced-air-cooled and four 225-kva 3-phase induction voltage regulators operated in triplex.

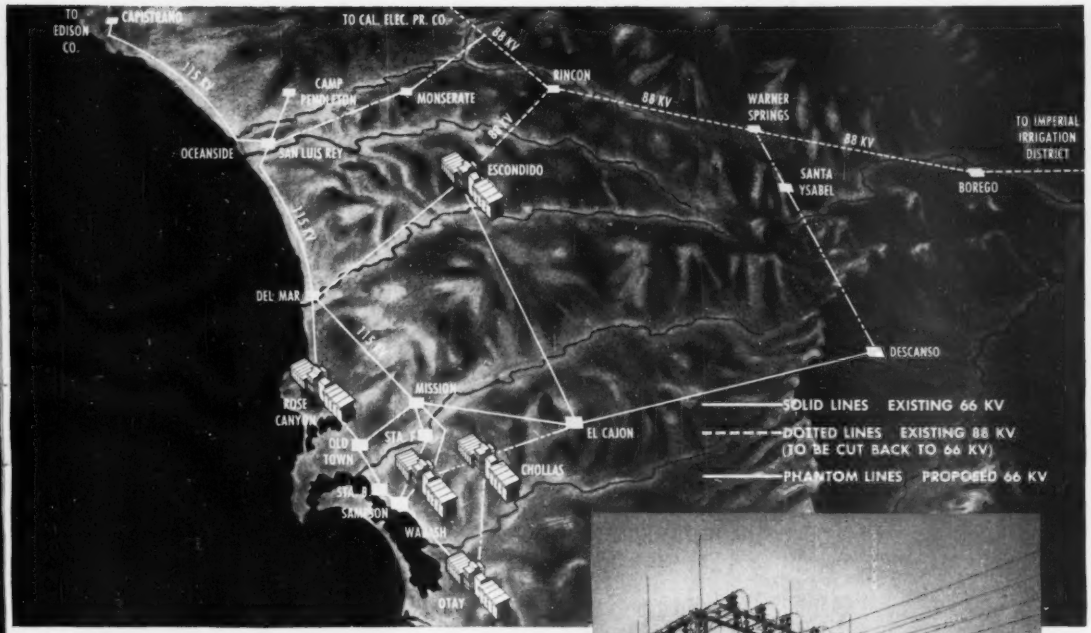
Saves engineering time, simplifies purchasing, speeds delivery to meet tremendous load growth.

Careful planning during the war years enabled San Diego Gas and Electric Company to expand its postwar system with exceptional speed—to meet the huge 350 percent increase in load. Additional generating capacity was the first consideration. But new substation capacity was also urgently needed to relieve badly overloaded equipment and to correct low-voltage conditions on parts of the system. Why did they standardize on **package** substations? Here's what they say:

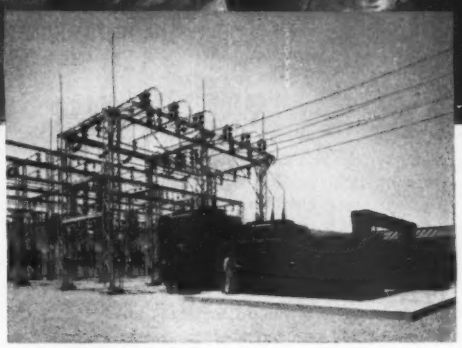
"This method of purchasing minimizes the engineering required since a single set of brief specifications outlining functional requirements is all that need accompany the single purchase order. Ordering all of the equipment from one manufacturer further reduces the engineering time required. It places on the manufacturer the responsibility of co-ordinating all of the various items of equipment and of supplying a workable substation, complete with installation, over-all arrangement, and over-all connection drawings. It frees the utility engineer from the details of co-ordinating and expediting and makes his time available for system planning where he can make more valuable contributions."

These considerations were important to the San Diego Gas and Electric Company. It permitted them, even with a small engineering force, to place orders promptly for complete substations, securing early places in the production schedules.

Apparatus Department, General Electric Company, Schenectady 5, New York.

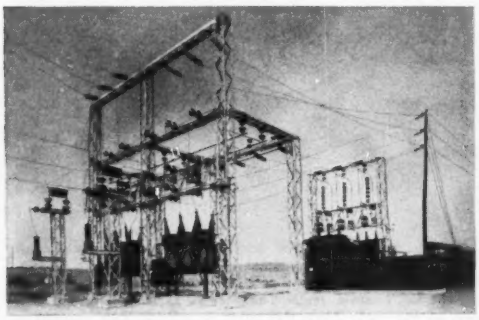


This map shows the planned expansion of the 69 kv transmission system of the San Diego Gas and Electric Co. New package substation locations are shown in red. Substations are functionally similar and made up of standard-design components, the main differences being in secondary voltage and type of regulation. Photographs of the package substations appear on these pages.

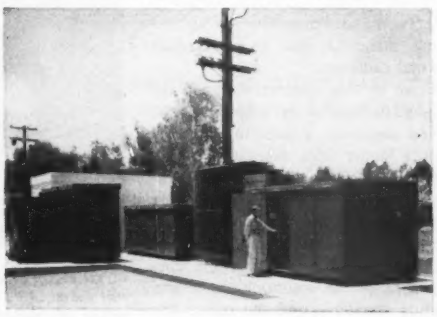


(Above) **ESCONDIDO SUBSTATION,** comprising two 3-phase, 66-kv to 12.47-kv, 6000-kva transformers and complete station structure.

OTAY PACKAGED SUBSTATION, rated 12,000/16,000 kva, transforms 69-kv to 12.47-kv. Photo shows current line traps (left) and large outdoor oil circuit breakers, also at left. At right, the transformers, switchgear, Thyrite* station-type arresters, etc.



(Below) **ESCO PACKAGED SUBSTATION,** including induction voltage regulating equipment and a 3-phase transformer rated 3000-kva self-cooled at 12,470/3,430 volts, Y/2,500 volts.

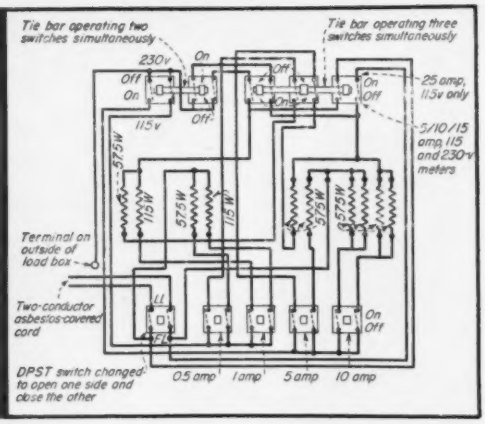


GENERAL ELECTRIC

321-72

*Reg. Trade-mark, General Electric Co.

TESTER'S TOOLS in tray fit above resistance units and rotating standard. Test leads are between units and standard



CONNECTIONS of load box for testing meters up to 25 amp. Input at full load is 3 kw at 115 or 230 v

Meter Test Kit

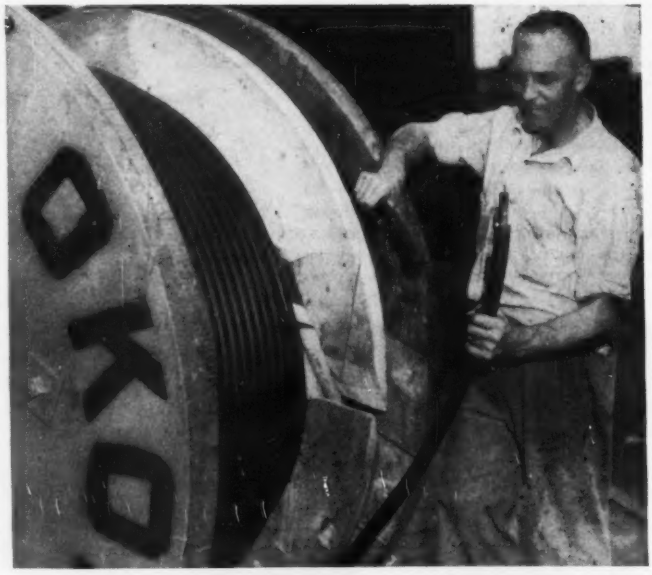
(*Continued from page 155*)

capacity, and six 5-amp, 115-v resistance units. Through switching combinations, 0.5, 1, and 1.5 amp are available for light load, and 5, 10, and 15 amp for heavy load at either 115 or 230 v. Another switching combination produces 2.5 amp for light load and 25 amp for heavy load at 115 v only.

The Chromalox resistance units are metal clad and have fins to improve radiation. Units are mounted in a metal frame that has switches on either side below the units so the entire device can be removed easily from the kit for replacement, cleaning or repairs. An aluminum asbestos barrier, between the resistance units and the adjacent rotating standard compartment, eliminates inaccuracy of the rotating standard due to insufficient thermal radiation.

Flow of test current through the resistors is limited by a specially designed sequence switch to a period slightly longer than necessary to take readings. Three conditions are produced when operating this switch. Starting at the off position, the first operation closes the current circuit of the test set. This energizes the current coils of the watthour meter and rotating standard, and the meter under test rotates. Second operation of the switch completes the potential circuit of the rotating standard, causing it to rotate. Third operation opens all circuits.

Use Split-Flange Reel In Emergencies



BOTH ENDS of an emergency portable cable are readily accessible on a split-flange reel designed by The Okonite Co, Passaic, N. J. The first 50 ft of cable are wound within the narrow section of the reel. Then the cable is carried over through a tapered slot in the central flange to main body of reel where the balance is wound. This dual drum can be transported on a reel cart to emergency site, where sufficient cable from the main section will be reeled off to traverse distance between terminals. Cable section remaining in narrow portion then can be easily unwound. This length is long enough to reach a connection 50 ft from reel location. The reel illustrated will hold 1,000 ft of 5-kv cable and is now being used by a power company

TROLLEY COACHES USE MORE THAN 1,000,000,000 KWH IN 1950

A modern electric trolley coach, like the one pictured above, uses on the average 175,000 KWH each year.

In seven years, the number of trolley coaches in operation in this country has nearly doubled.

There are good reasons why transit operators have continued to apply these vehicles at such a rapid pace since the end of World War II. Foremost among these is the fact that trolley coaches, correctly applied, are the most profitable form of urban transportation.

This modern electric vehicle offers many advantages. Simple maintenance, high availability, large carrying-capacity and smooth, rapid acceleration make it attractive to the transit operator. And the clean, quiet and odorless operation of these electrics attracts and holds riders.

Presently, more than 7,000 trolley coaches are in operation in this country. Within the next five years, it looks as though this number will be doubled.

You are interested in promoting economically-sound applications of electricity. Promote trolley coaches.

Apparatus Department, General Electric Company, Schenectady, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

151-28

Formulas Determine Conductor Path At Quarter Span

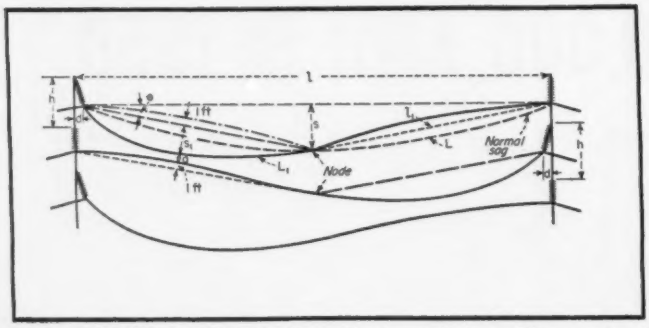


FIG 1—CONDUCTOR POSITIONS due to dancing conductors with one node at mid-span. In this instance, characteristic of dancing is a synchronous motion

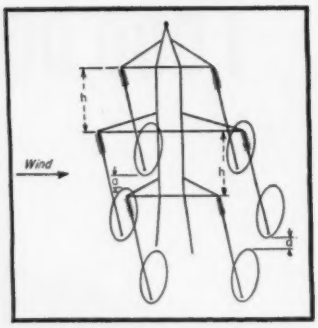


FIG 2—ELLIPSES trace paths of conductors at quarter span positions

LESLIE W. TOYE

Engineer, Electric Distribution Dept
Public Service Electric & Gas Co
Newark, N. J.

(Eq 1) $S=\sqrt{\frac{3l(L-l)}{8}}$

Where S = sag of conductor
l = span between towers
L = length of wire between fixed supports

(Eq 2) $l_1=\sqrt{(\frac{l}{2})^2+S^2}$

Where l_1 = distance from insulator support to mid-span node point

(Eq 3) $L_1=l+\frac{8S^2}{3l}-\sqrt{(\frac{l}{2})^2+S^2}$

Where L_1 = length of wire from node position to fixed support

(Eq 4) $S_1=\sqrt{\frac{3\sqrt{(\frac{l}{2})^2+S^2}\left(l+\frac{8S^2}{3l}-2\sqrt{(\frac{l}{2})^2+S^2}\right)}{8}}$

Where S_1 = major axis of the ellipse

(Eq 5) $h=(S_1+a+1)\cos\theta$

Where h = vertical separation at tower supports
a = design clearance

(Eq 6) $K=\sqrt{(S_1+1)^2-(S_1-1)^2}$

Where K = minor axis of the ellipse

A formula has been developed for describing a path of all probable positions of a dancing conductor at a distance 25% of the span length from the tower structure. It is based upon the well-known equation (see Eq 1 in the box on this page) for determining the sag of the wire between fixed supports from the properties of the parabola. Illustrations at top of this page show a longitudinal and transverse elevation of such a condition.

The formula developed here is for the longer spans. In various papers empirical rules have been given for describing ellipses at the center span only. On short spans such rules seem reasonable, but for long spans of the order of 800 ft or more, the rules seem to be too conservative to use. This conclusion is made from observation on the longer spans which exhibit ellipses at the quarter-span point with one node at mid-span.

To determine a safe vertical separation of conductors at the tower locations due to dancing with one node at mid-span, the formula from the parabola when the length of wire is known is given in Eq 1. In Fig 1 the dimension l_1 is the distance from the insulator support to the node point at mid-span. This is expressed in Eq 2.

Likewise the length of wire L_1 from the node position to the fixed support will be as given in Eq 3. By substituting the values l_1 and L_1 in Eq 1, Eq 4 is developed to obtain S_1, the major axis of the ellipse.

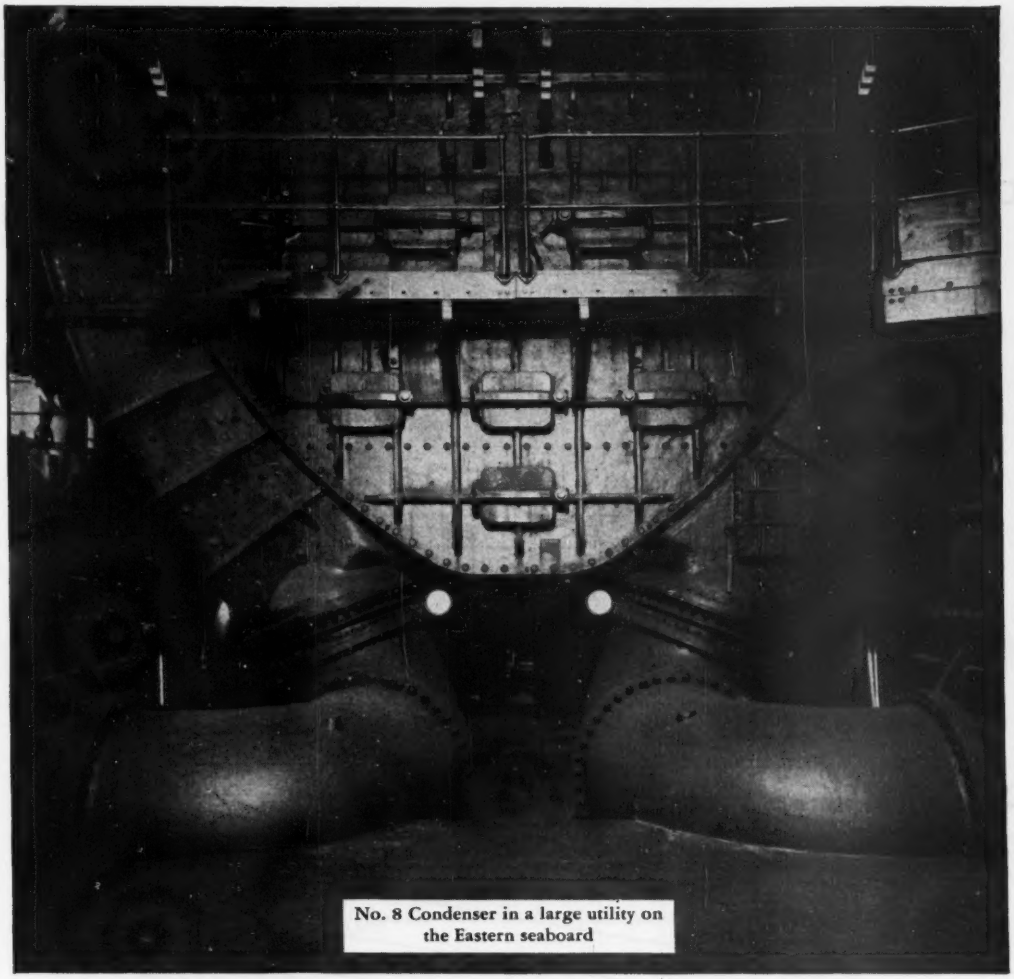
The design clearance in Fig 2 is based upon the minimum phase-to-phase voltage clearance. When the distances S_1 and a are determined, add 1 ft (based on field observation). Also adjust the summation of these distances in a vertical plane by including a correction for cos θ, where θ is the angle formed between the line of supports and the node point of the mid-span. Therefore h, the required vertical separation at the tower supports, will be as given in Eq 5.

The correction factor, using Eq 5, may be ignored unless the sag between tower supports exceeds 5% of the span length.

Longitudinal movement at the tower supports is rarely experienced but may occur at isolated locations in a long transmission line. Where there is longitudinal movement of the insulator string toward the center of the span, a correction can be made for such a condition. The deflection d can be assumed to be an additional amount of wire which is known. Add the deflected amount d in terms of wire length, and solve for a new value S in Eq 1 and proceed as before. The value of d may range between 6 in. and 1 ft at any one location with reasonable accuracy.

The reach of the ellipse at the quarter-span location is derived by using the major axis equal to S_1 plus 1 ft as shown in Fig 1. To determine the minor axis: Assume the foci equal to 1 ft; then the distance between the two fixed points of the ellipse is equal to (S_1 - 1). The minor axis K is determined by direct triangular relationship as in Eq 6.

Sag S, Eq 1, is usually based on a loading of ½ in. radial ice, 30-mile wind, 32 F in the heavy loading area.



No. 8 Condenser in a large utility on the Eastern seaboard

don't let FOULING get your figures ALL FOULED UP!

● One important factor taken into account when figuring on the heat-transfer capacity of a condenser is fouling. But the effect of the tube alloy on both rate and amount of fouling is sometimes ignored in design calculations. The acceptance test of a condenser is made with clean tubes. However, the average heat transfer rate varies with time, and fouling is the chief factor in such variation. In many applications this indicates the need for serious consideration of cupro-nickel tubes, which are recognized to have superior anti-fouling characteristics, as well as high resistance to corrosion, erosion, impingement. Thus it can be said that cupro-nickel, 30%, will provide more uniform transfer rates over a period of time, require cleaning much less often, and last longer . . . Revere makes condenser tubes in cupro-nickel as well as in all the other customary copper alloys. We will gladly collaborate with you in a study of the economics of condenser tube selection to meet your needs for true economy. Write for reprint of article entitled "What Factors Should You Consider in Selecting Condenser-Tube Alloys?"

REVERE 150 YEAR OF SERVICE TO AMERICA

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

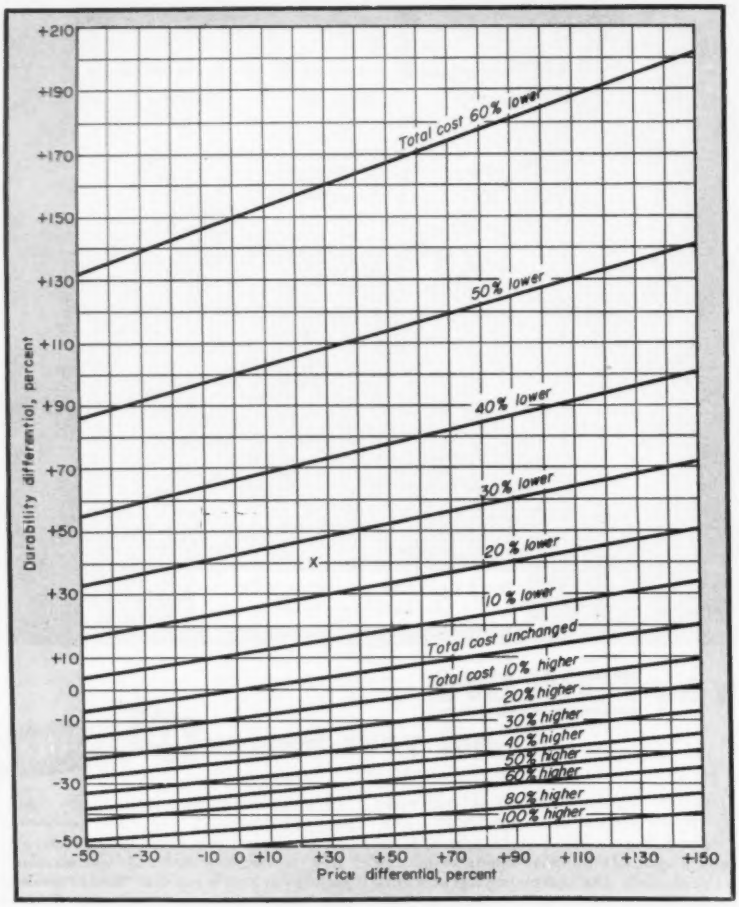
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

Relationship of Price and Life of Paint To Cost of Tower Protection per Year

Nomograph shows how increases or decreases in paint price and paint durability affect the cost of protection per year per unit area for steel transmission towers. Assumed hourly wage rate in dollars is a constant taken as 0.6 times the paint cost in dollars per gallon (or W = 0.6 P) at origin, or zero point on chart

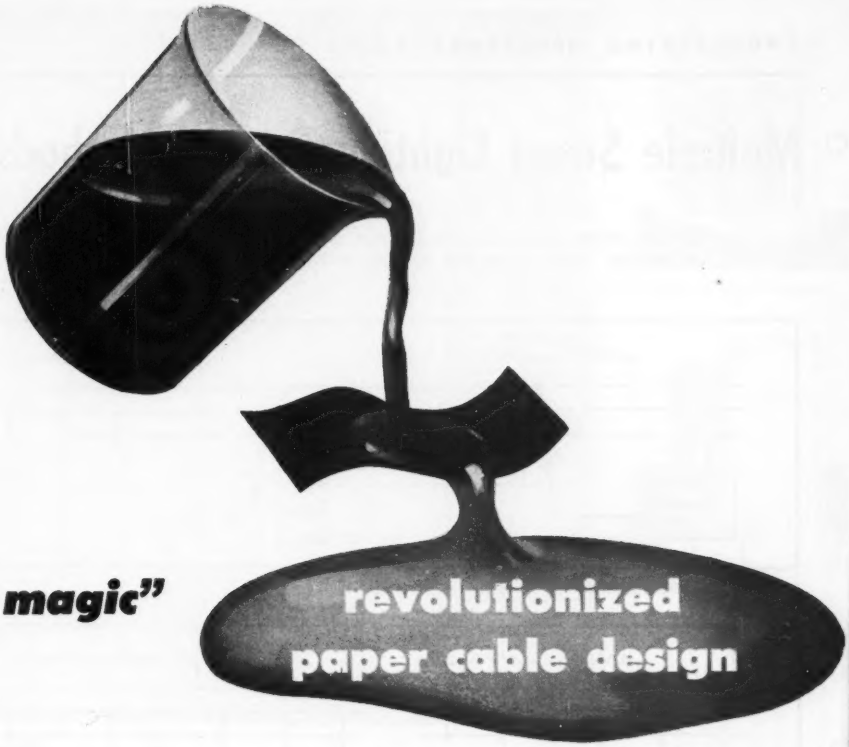


Example . . . Assume a choice is available between two grades of paint. Paint A costs $4 per gal and can be expected to endure for five years. Paint B costs $5 per gal and can be expected to endure for seven years. Price differential is +25% and durability differential is +40%.

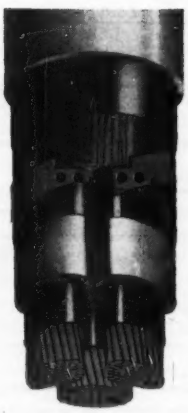
Effect on the annual cost of protection is found by locating the intersection of the +25% vertical ordinate with the +40% horizontal ordinate. This point is indicated by *X* between the lines for total cost 20% and 30% lower.

Interpolating between the curves at this point *X* shows that paint B (even though 25% higher in price than paint A) will reduce the annual cost of protection by about 26%. (Linear interpolation introduces a slight negative error.)

Adapted from a manual entitled "Transmission Tower Painting" published by Joseph Dixon Crucible Co.



how "black magic" revolutionized paper cable design



Everybody knew that in paper cable the oil deteriorated under heat and electrical stresses.

But recalling that carbon black can purify oil and tends to stabilize it, Anaconda cable research men asked themselves why it couldn't do the same in paper cable.

They found it could and did!

Today ANACONDA Type CB* (Carbon Black) Power Cable offers the best power cable service that money can buy.

Not only does it contain carbon black, but also it can be made with resilient binder and sheathed with F-3**, the superior ANACONDA Alloy-Lead Sheath that is so resistant to slow-bending fatigue, creep, burst, abrasion, vibration and aging.

Net result: you get maximum cable life and economy.

Want more facts? Proof? Ask your nearest Anaconda Sales Office. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

B1347

*CB—Carbon Black
(U. S. Patent 2,102,129)
Reg. U. S. Pat. Off.
**F-3—Arsenic-Lead Alloy
(U. S. Patents 2,300,788 and 2,374,755)
Reg. U. S. Pat. Off.

The right cable for the job ANACONDA®

WIRE AND CABLE

Multiple Street Lighting Control Methods

Cascade scheme and pilot-wire schemes are shown by diagrams. These control methods are adapted from construction methods of Pacific Power and Light Co, Portland, Oregon

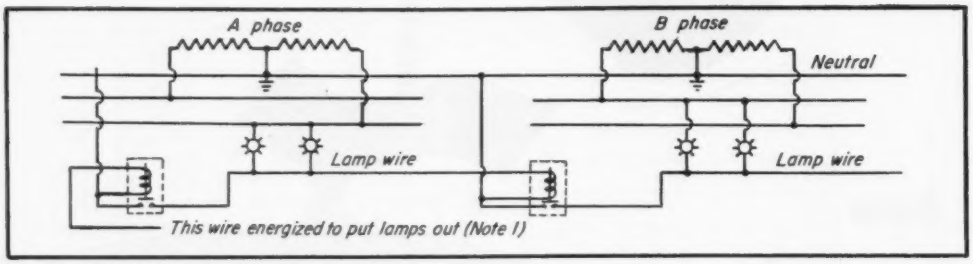


FIG 1—CASCADE SCHEME with normally closed relay

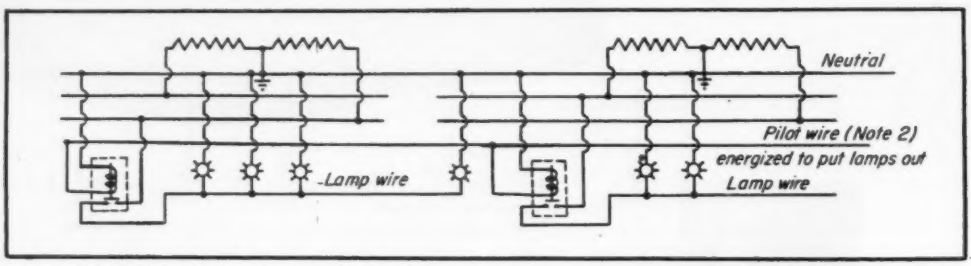


FIG 2—PILOT-WIRE SCHEME with normally closed relay

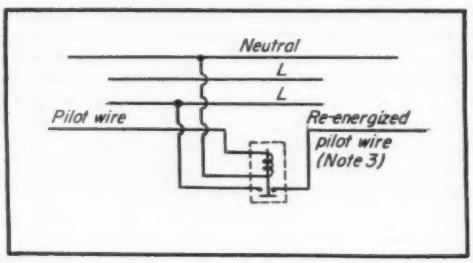


FIG 3—NORMALLY OPEN RELAY for re-energizing pilot wire

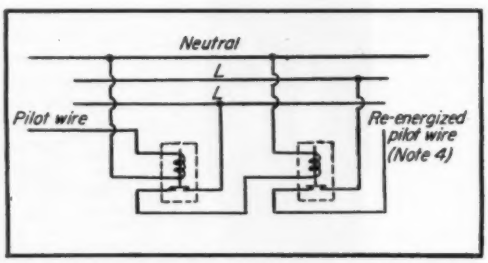
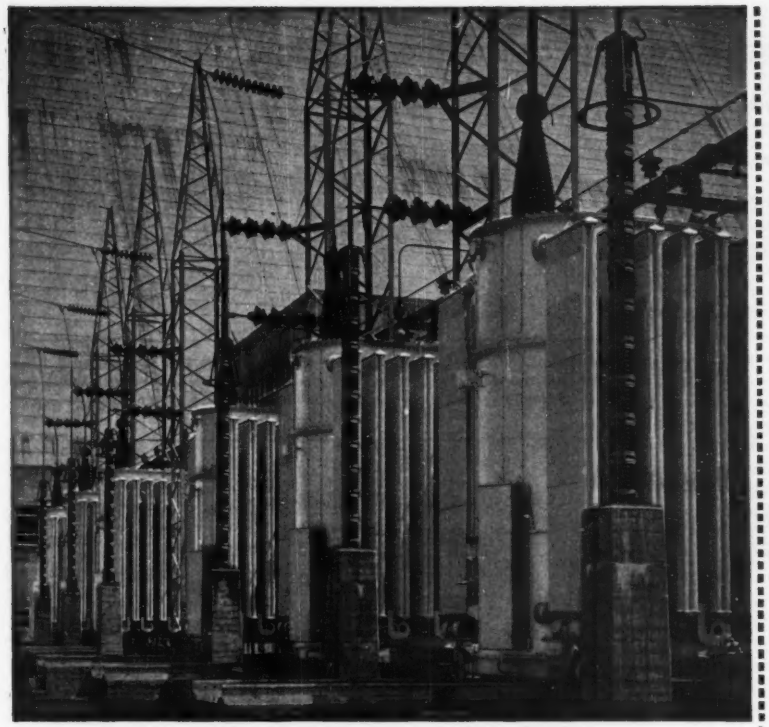
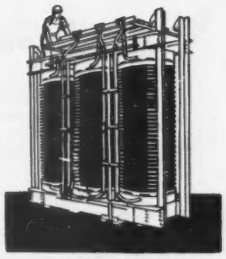


FIG 4—RELAYS, normally closed, for re-energizing pilot wire

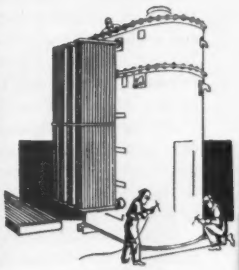
Notes:

1. Beginning of cascade may be controlled by manual switch, series multiple relay, time clock, photoelectric relay or normally open relays on pilot wire, as specified.
2. Pilot wire may be controlled by manual switch, series multiple relay, time clock, or photoelectric cell as specified and fused with 50-amp fuse.
3. If voltage drops below 90 v, due to length of wire and relay load, pilot wire may be re-energized as indicated.
4. Normally open or normally closed relay is opened or closed, respectively, when relay is de-energized.

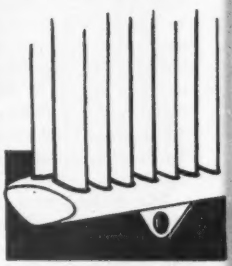




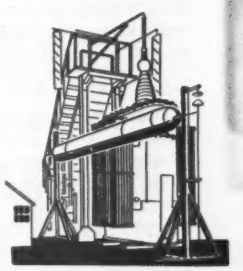
Core and Coil Construction



Tank Construction



Radiator Construction



Transformer Testing

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The features that are built into every Moloney Power Transformer are the result of years of exhaustive study and research. Research that is based on records of results actually obtained . . . on more efficient operating performance and lower maintenance costs.

Take, for instance, Core and Coil Construction. Core type construction is used, providing a maximum amount of winding surface exposed to the oil to assure efficient dissipation of heat. To insure the greatest possible protection against distortion under the most severe operating conditions, windings are rigidly braced.

Tanks are made of high grade steel, electrically welded, with Z bars or box-type reinforcements . . . Radiators are of all-welded construction with tubes spaced in a double row for easy cleaning and painting. There is no "hard-to-get-at" center row. All welds are external. Headers are designed so that water cannot collect and cause rust.

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Illustration above shows a Moloney Power Transformer installation: 168,000 Kva of installed capacity, transforming 13,800 to 161,000 volts.

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Differential Relaying For Double-End Unit Substations

A. J. NICHOLSON
Electrical Engineer
Kansas City Power & Light Co
Kansas City, Mo.

To provide capacity for large load increases engineering analysis favored the smaller double-end type unit substations. Each substation consists of two 2,000/2,500-kva transformers with load ratio control, each fed from a separate 13.2-kv underground cable, and each serving a 200-amp, 4,330-v, 3-phase, 4-wire circuit. Automatic throwover is provided for emergency in case of loss of one 13.2-kv cable.

The operational functions of these new unit substations were to be as nearly like the old substations—eight large, indoor, automatic substations—as possible.

Under normal (automatic) operation, each 4-kv circuit is independent of the other with the tie breaker, T, open (see Fig 1). When voltage is lost on one transformer, undervoltage relays, after a 4-sec delay, open its breaker and close the tie breaker, restoring service to the 4-kv circuit. When voltage is restored, and after a 3½-min delay, relays operate to close the transformer breaker and open the tie breaker.

The 80 to 1 current transformers, used for circuit relaying, are located in the bus between the feeder breaker and transformer. The relays provide instantaneous first tripout, with time delay tripping for reclosing at 45 sec and 75 sec respectively, locking out on the fourth trip-out.

Improved Relay Setting

Due to the location of these current transformers, 1½ to 2 times the usual relay minimum pick-up current is required. This undesirable higher-than-normal relay setting could be improved by reducing the current transformers to 40 to 1 and locating them in the outgoing circuit (Fig 2). Relays could then be set properly for a 200-amp circuit. Although this complicates the control circuits and requires transferring them under emergency conditions, this arrangement for protective relays is considered to be better than arrangement in Fig 1. However, under emergency conditions both circuits (Fig 2) will be open in case of a fault on either circuit.

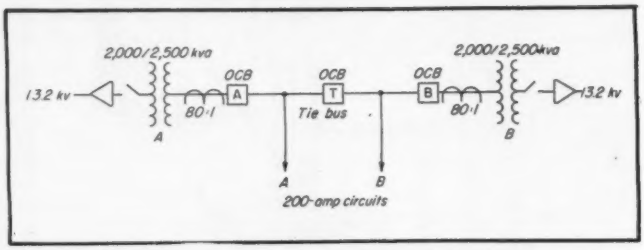

FIG 1—RELAYING SCHEME uses current transformers in bus between each feeder breaker and transformer. In this arrangement current transformers require high ratio, 80:1, and 1½ to 2 times the usual minimum pick-up current

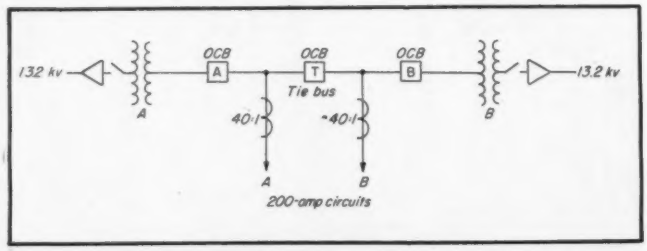

FIG 2—IMPROVED SCHEME has current transformers located in outgoing circuits so that current transformer ratio can be reduced to 40:1. However, this scheme requires transferring trip circuit under emergency conditions

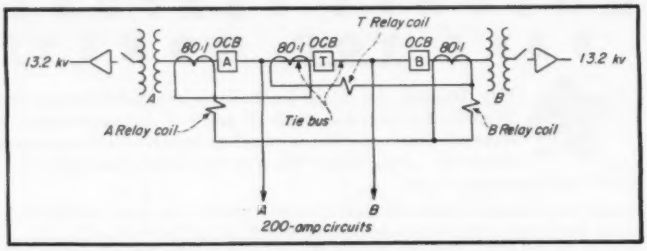

FIG 3—DIFFERENTIAL SCHEME of current transformer and relay connections allows low relay settings and eliminates emergency transfer of tripping circuits

A third arrangement of current transformers and protective relays is shown in Fig 3. By using the differential principle of current transformer and relay connections, it is possible to take advantage of low relay settings and eliminate the transfer of tripping circuits under emergency conditions. A third set of current transformers and relays is used for tripping the transfer breaker under emergency conditions. A three-shot reclosing relay is provided for the transfer breaker.

Under normal conditions, with both transformers energized and the transfer breaker open, the relays on each transformer breaker will function on all faults on the circuit fed by that transformer, tripping the breaker, and reclosing in the normal manner. With breaker A open and transfer breaker T closed, transfer breaker relays will function on circuit A faults, tripping transfer breaker T and reclosing in the normal manner without disturbing circuit B. This scheme has some objectionable features but eliminating them would be expensive and not economically justified.

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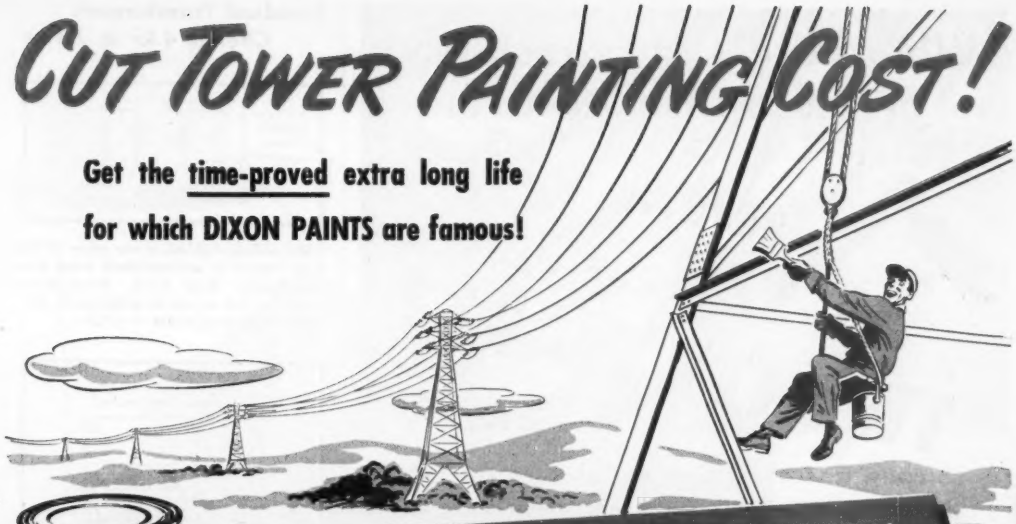

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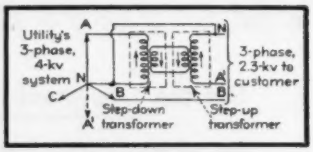
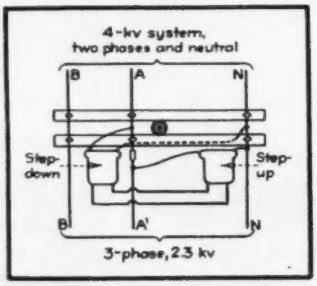
Standard Transformers Change 4 kv to 2.3 kv



VOLTAGE REVERSAL in one phase of the 4-kv system is accomplished using two transformers from stock. Three-phase service at 2.3 kv can be obtained by customer from lines A'BN or A'CN



POLE-TOP CONNECTIONS to give the customer 3-phase, 2.3-kv service involve two phases and the neutral of the electric utility's 4-kv system

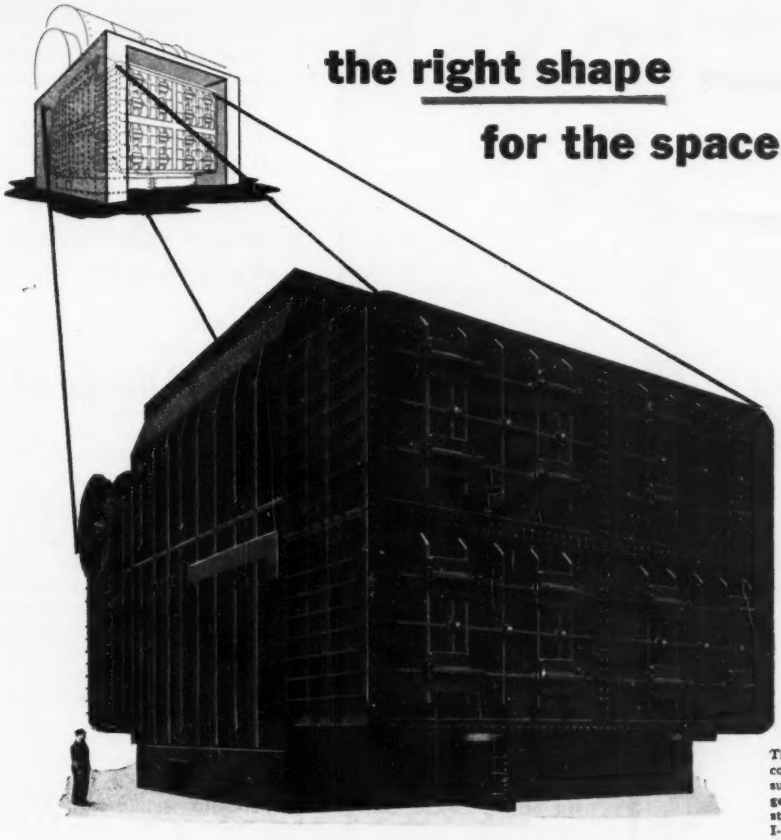
HARRY L. SWICEGOOD
Assistant Distribution Supt
Brockton Edison Co
Brockton, Mass.

Brockton Edison Co's old transformers of infrequently used ratio are maintaining 3-phase, 2.3-kv service in areas converted to 4-kv, 4-wire distribution. Since some customers own their 2.3-kv, 3-phase transformer banks, distribution lines, and motors, it was desired to continue 2.3-kv service without purchasing special autotransformers for these customers.

Two Phase Wires and Neutral

Two phase wires and the neutral of the 4-kv system are used in the transformation. Voltage of one of these phases is reversed by using two old standard transformers—one steps down and the other steps up the 2.3-kv phase voltage of the 4-kv system. The old transformers, taken from stock, have secondary windings of 115, 230, 440, or 575 v. Capacity of each of them equals original three-phase kva rating divided by the square root of three. This means that capacity of each of the old transformers is re-

the right shape
for the space available



This giant Rectangular Condenser, containing 90,000 sq ft of cooling surface, serves a 150,000 kw turbo-generator at a mid-western central station. The compactness of the I-R design made it possible to fit the cube-shaped space available.

that's one of the reasons why

I-R RECTANGULAR CONDENSERS

give you so much more kw per cubic foot of available space

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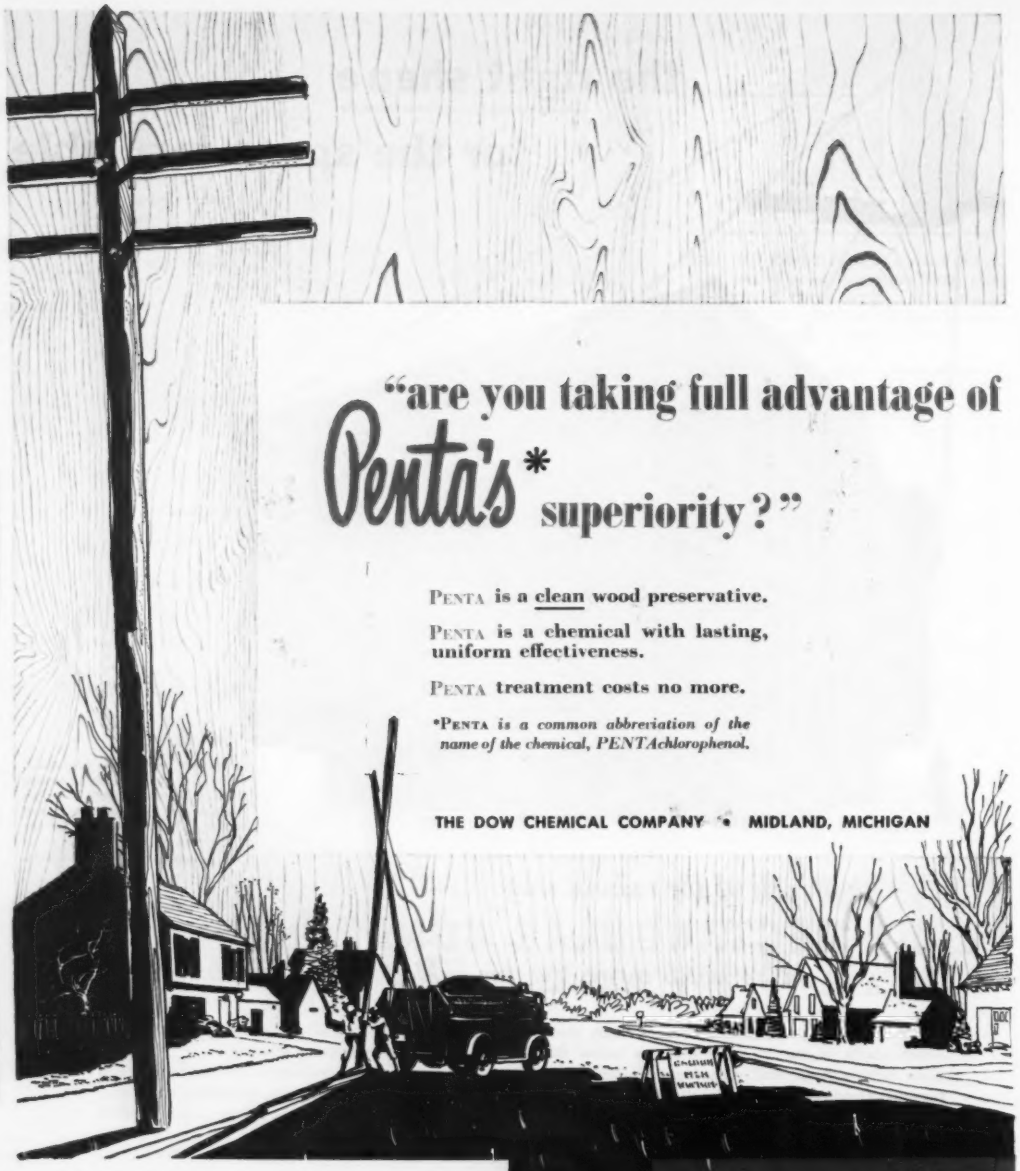

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Two Grounding Assemblies For Rural Line Poles

Two types of pole grounds, one a coil of wire on a pole butt and the other a ground rod near the pole, are used on rural lines of Gulf States Utilities Co, Beaumont, Texas.

The butt coil type, or preferred method, is used on all new construction. Butt coil and ground lead to top of pole are attached to the pole before it is set in the ground. This method consists of coiling at least 12 ft of No. 6 bare hard drawn copper wire and stapling it to the bottom of the pole and extending the wire, in a continuous section, to the top of the pole. Butt coil and ground lead in many instances are installed on the pole before it is hauled out to location.

The ground rod type, or alternate method, is used where poles are already in place and the butt coil cannot be used. In this method a ½ in. x 8 ft ground rod is driven in the ground, in a vertical position if possible, approximately 1 ft from the pole. The ground lead is attached to it by a suitable ground clamp. The ground lead is No. 6 bare hard drawn copper wire stapled to the pole at approximately 2-ft intervals.

Some significant notes on installation are:

1. Ground wire to be located on same side as neutral wire and in quadrant away from direction of traffic (see Fig 1).

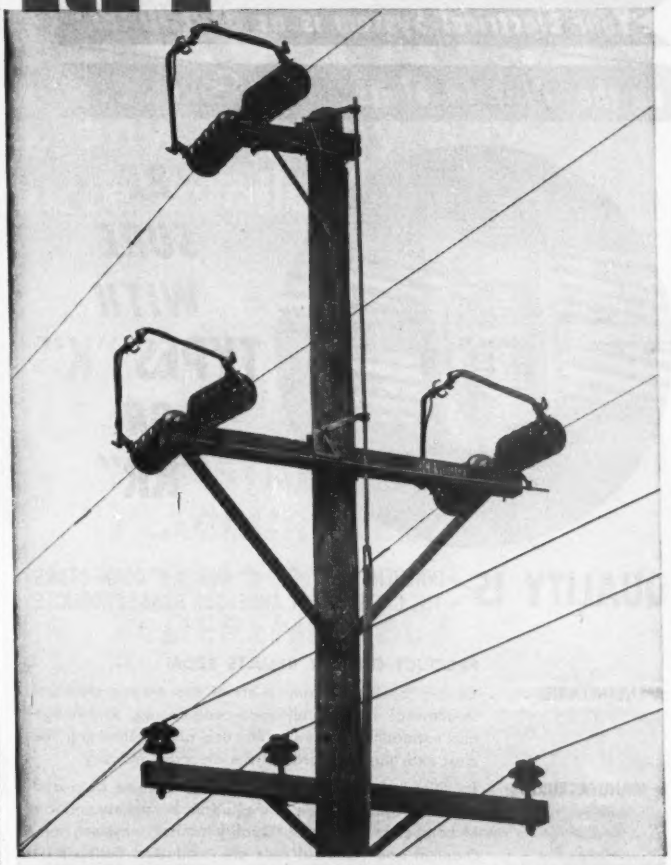
2. Staples to be 2 ft apart except for a distance of 8 ft above ground where they shall be 6 in. apart unless covered by ground mold.

3. Ground mold is not required in rural (unsettled) areas.

4. Ground mold shall be installed over all ground wires from point where they first contact top of pole to a point at least 40 in. below lowest supply conductor.

5. Ground wire shall clear all hardware by 2 in. (minimum) and shall be

KPF POLE TOP SWITCHES



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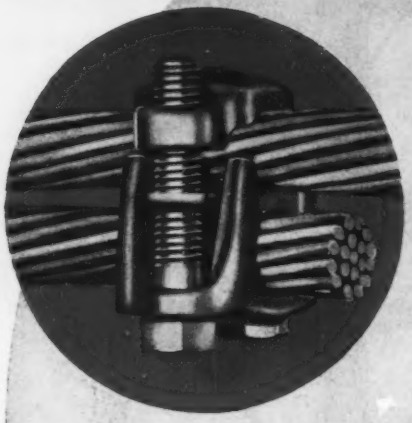

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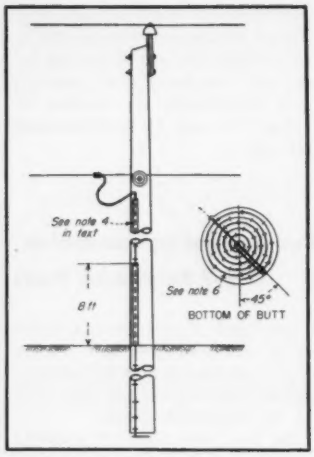

FIG 1—BUTT COIL pole grounds are preferred by Gulf States Utilities Co for rural lines. Wire is attached to pole before the pole is set in place

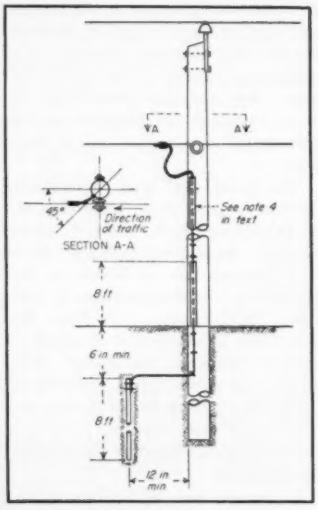

FIG 2—GROUND ROD grounding is the alternate method used when poles are already in the ground

stapled in order to maintain this clearance.

6. Butt coil type of ground shall have not less than 12 ft of No. 6 bare copper wire below ground level. This length may include both the coil and the riser and must be one continuous piece at least to the ground surface (see Fig 1).

7. Ground rod type shall have a ground wire of No. 6 bare copper wire minimum (see Fig 2).

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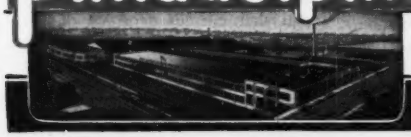

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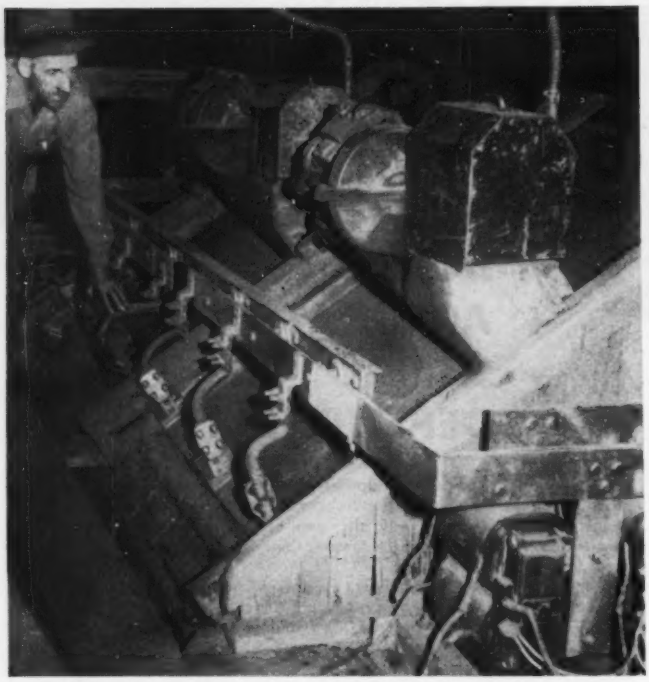
LimiTorque Valve Controls

Electrically Heated Clay Screens Double Output



CLAY SCREEN heated electrically from transformer providing 2,500 amp at 4.5 v. Wire mesh acts as a resistance heater which evaporates the moisture in the clay, and speeds production. Note bus straps connected to top and bottom of the screen

R. H. HIVELY
Appalachian Electric Power Co
Charleston, W. Va.

The Standard Brick and Supply Co of Charleston, W. Va. has installed 30 kw in electrically heated clay screens. Since their installation, the daily usable shale tonnage has more than doubled. After experimenting with this heating idea on one screen, the results were so successful that they immediately applied the heat to the second screen. These screens entirely eliminate blinding and free the operator for other tasks in the plant. Screens last longer and a finer mesh can be used—thus increasing the quality of the product. There is less noise, less dirt and working conditions are better. Even with this finer mesh screen, it is still able to pass 80% of the fine shale on the first pass. Thus, this high percentage of first pass shale greatly reduces the amount of circulation necessary.

This company manufactures a high grade brick and building tile which is made from shale mined by the open pit method.

Shale, whether it 'is mined underground or by the open pit method, must be screened in one state of its processing in order that the coarse shale particles or other coarse foreign matter be separated from the fine

ELECTRICAL ENGINEERING IN INDUSTRY

particles of shale. This fine shale produces a smooth, homogeneous, high grade brick.

The normal procedure for screening this shale, is to run the shale over a vibrating screen, recirculating the shale that initially passes over the screen until all the fine shale has been passed through the screen. This shale, when mined by the open pit method, usually has an appreciable moisture content. When it is mined underground, water is usually added to keep it from creating excessive dust. Open pit mined shale, that contains from 6 to 10% moisture when it is passed over the screen, is used at this plant. This dampness in the shale has caused particular difficulty during the screening process. One man had to be stationed at each screen to beat the screens as the damp shale came over, to prevent blinding of the screens. This was hard on the screens, and did not prove too effective in screening the shale.

Then electric heat entered the picture—the screens were heated by utilizing a transformer and bus straps connected to the top and bottom of the screen. Approximately 12 kw of heating was applied to the first screen, (2,500 amp at 4.5 v) with the screens acting as heating elements.

The principle involved is simple. The wire mesh screen acts as a resistance heating element and the particles of clay passing over the screen have part of their moisture evaporated. Thus their adhesive qualities are greatly reduced. Although it has been found that current densities of approximately 90 amp per sq ft are required for shale of approximately 10% moisture content, the screens

(*Continued on page* 178)

VERSATILITY IS IMPORTANT

IN CUTOUT APPLICATION

HERE'S WHY . . .

Increasing power demands and material shortages due to accelerated defense efforts are certain to develop abnormal conditions on your distribution system. Excessive loads, increased fault currents and problems in equipment procurement will require greater flexibility in the application of protective equipment.

Southern States' three classes of open type dropout cutouts offer this flexibility in meeting a wide range of operating requirements.

Interchangeability of fuse tubes in given classes and kv ratings (shown in the accompanying tables) illustrate the degree of versatility in the Southern States line of expulsion cutouts. Only the 15 kv rating in each class is shown. However, the same pattern is followed in the 5 kv and 7.5 kv ratings.

Distribution Cutout Rating		Contact Rating	Fuse Tube Rating	
KV	AMP	AMP	AMP	Interrupting Rating (RMS Amp)
Type 33-D				
15	50	100	50	1200 4000
15	100	100	100	2000 4000
15	200	200	200	4000

Notes: 1. In a given voltage rating all Type 33-D cutout tubes are mechanically interchangeable.

2. Continuous current or interrupting capacity can be changed in accordance with the above table by replacing tubes except in the case of conversion from a lower rating to 200 ampere rating, in which case the fuse holder contacts must also be changed.

Distribution Cutout Rating		Contact Rating	Fuse Tube Rating	
KV	AMP	AMP	AMP	Interrupting Rating (RMS Amp)
Type H-33-D				
15	50	200	50	6000
15	100	200	100	9000
15	200	200	200	11000
Type HH-33-D				
15	50,	300	50	8000
15	100	300	100	12000
15	200	300	200	16000
15	300	300	300	20000

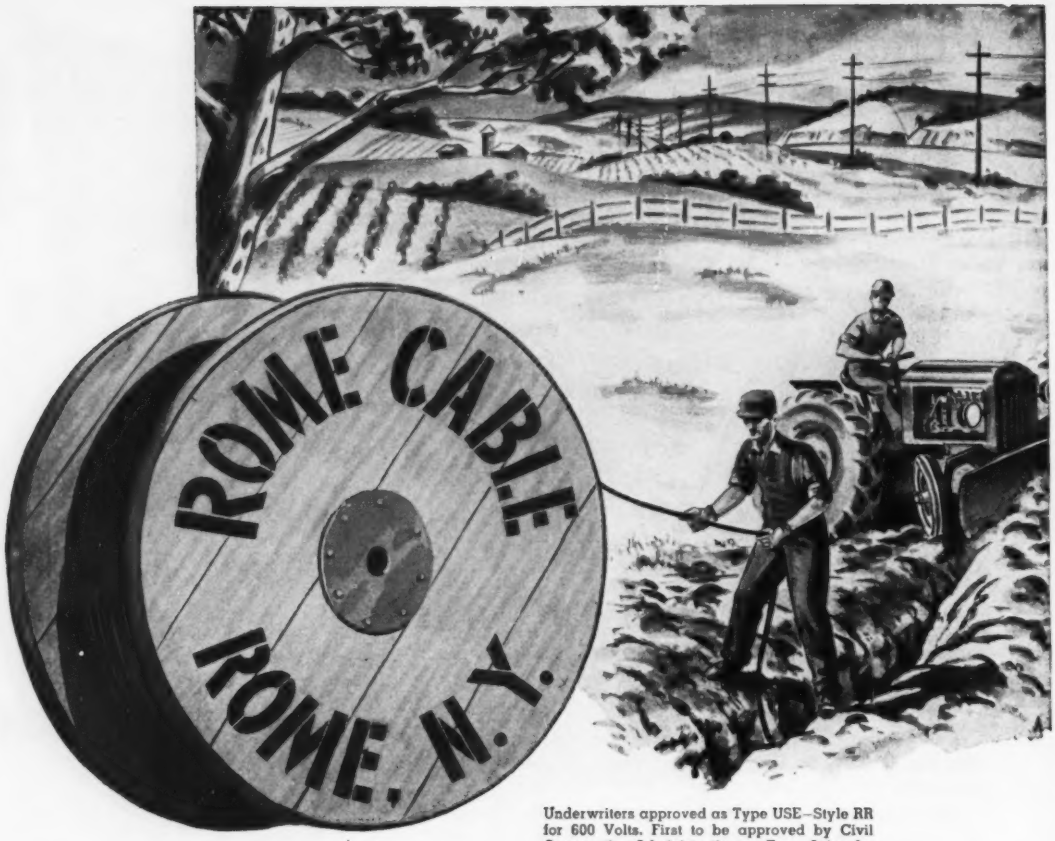
Notes: 1. Continuous current or interrupting capacity can be changed in accordance with the above tables by replacing tubes. In a given voltage rating all tubes are interchangeable.

2. The Type H-33-D and the Type HH-33-D fuse holders are identical except for contacts. The Type H-33-D has 200 ampere contacts and the Type HH-33-D has 300 ampere contacts.

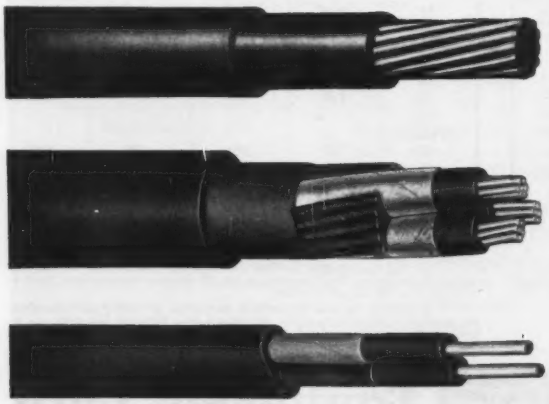
3. All 50, 100 and 200 ampere fuse tubes for both type cutouts can be applied in either cutout. The 300 ampere type HH-33-D fuse tube can be used in the Type H-33-D fuse holder if the 300 ampere contacts are substituted for the 200 ampere contacts furnished in the Type H-33-D.

Southern States Equipment Corp.

HAMPTON GEORGIA



Underwriters approved as Type USE—Style RR for 600 Volts. First to be approved by Civil Aeronautics Administration as Type A insulation for airport wiring under Specification L-824.



RECOMMENDED FOR

DIRECT EARTH BURIAL

OVERHEAD

IN CONDUIT

Insure Your Power Load With

RoMarine - RoPrene

ALL-PURPOSE POWER CABLES

Street Lighting Cables

Rome manufactures a wide range of high and low voltage cables for underground, or overhead wiring of series and multiple lighting systems . . . *designed to meet your requirements.*

RoZone*-RoPrene Series Street Lighting Cable—5000 Volts

RoLene-Rome Synthinol* Series Street Lighting Cable—5000 Volts

RoLene Ornamental Pole and Bracket Cable—
4000 to 12000 Open Circuit Voltage

JUST OFF THE PRESS!

The New Rome Power and Control Cable Catalog

This new sixty-page catalog will be an important addition to your book shelf! Complete in every detail, it includes descriptions, test data, specifications and suggested applications for all Rome Power and Control Cables. You'll find it invaluable for specifying. Mail coupon below today!

*T. M. REG.

You can't beat RoMarine-RoPrene for secondary network circuits, underground entrances, street lighting, or general purpose wiring. Exceptionally versatile, it is equally at home in country or city . . . can be installed direct in earth, in underground ducts, conduit or in air. If it's RoMarine-RoPrene you *know* you're right.

For long, economical service life RoMarine-RoPrene gives you *double protection* against costly circuit failures. RoMarine insulation affords high resistance to heat and moisture. The RoPrene (Neoprene) sheath has excellent resistance to oils, acids, alkalies, corrosive fumes, flame and abrasion. Its wide acceptance attests its popularity . . . hundreds of thousands of feet in service have proved its dependability.

RoMarine-RoPrene is less costly, easier to handle, tap and splice than lead sheathed cables. It is unaffected by electrolysis, extreme temperature changes and installed underground provides insurance against power outages from destructive storms. Its versatility reduces inventory.

IT COSTS LESS TO BUY THE BEST

ROME CABLE CORPORATION, Dept. EW1, Rome, N. Y.

Please send copy of new Rome Power and Control Cable Catalog.

Name .....

Company .....

Address .....

City ..... *Zone* ..... *State* .....

ROME CABLE
Corporation
ROME · NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.

Heated Clay Screens

(*Continued from page* 174)

themselves do not get hot as might be expected with this density. This is due to the fact that the clay serves to dissipate this heat as it is produced.

This particular application of electric heating is comparatively recent, and its extended possibilities are unlimited. Already, it is being tried with success in some cinder block plants and at a coal processing plant. It definitely provides a potentially excellent resistance heating load.

Stairway Lighting Comes in Long Packages

FROM ROOF TO BASEMENT the stairwell lighting is supplied from a single 40-ft fixture at Line Material Co's new office building in Milwaukee, Wis. Fixture is supported only at top and bottom. Extruded aluminum tubing was used to mount two T-12 single-pin lamps controlled from remote auxiliaries. Fixtures for both building stairways are designed so they can be increased over 100 ft in height to accommodate the four stories that can be added at a later date

Heated Floor for Chicken Brooding

General Electric Co photo

IN THIS electrically-heated brooder 3,000 chicks are kept warm and healthy

Successful chicken brooding on a large scale is now being accomplished in Georgia through the use of electrically heated floors. Emmett Climer of Rome, Ga., recently completed a 3,000-chick broiler house, and reported that the cost of operation with electric heat is less than three cents per chick.

Four inches of cinders, rock or gravel covered with felt was used for the base of the floor. Soil heating cable was placed on three inches of insulation mix and covered with an inch of concrete to make the radiant heating slab. The heat is regulated by a thermostat, in the center of the floor, which controls a magnetic switch.

Other chicken farmers are picking up the idea, and two new broiler houses with capacities for 2,000 and 4,000 chicks are expected to be installed in Whitfield County, Ga., late this spring.

Because there is no crowding of the chicks toward the source of heat, a better atmosphere is maintained in the broiler house. This, Mr. Climer said, brings about faster feathering and a lower mortality rate of the birds.

Load Building Notes

• Complementary, not competitive—that's how the home freezer and locker plant are related. Or so it appears from a study in the September 1950, issue of "Marketing Activities," a publication of the Production and Marketing Administration of the USDA. Use of lockers is increasing for quantity storage of food that is to be removed in smaller amounts as needed and held until used in home freezers. Also locker services of preparing and processing foods before freezing are being supplemented by sales of foods at quantity prices and by sales also of home freezers.

• Open for public inspection in November was an all-electric, "Thermo-Con" home in Houston, Texas. "Thermo-Con" is a light-weight, cellular concrete developed by Higgins, Inc, New Orleans. Prominent among the electrical features, installed under guidance of the Houston Lighting & Power Co, is "Light Conditioning" which is in accordance with the Nela Park recipes.

Your construction

Memorandum

From. W L. MARTIN, ENGINEERING DEPARTMENT

To J. Forbes, Construction Department

Subject. I-T-E Switchgear

Jim,

On our order #65136, I-T-E furnished us today with switchboard floor plan, front view drawings, and single line diagrams. We can run conduit, pour floors and set the channel base, ahead of schedule!

I-T-E will ship the channel base when we are ready.

Bill

because

When you build a new building or expand existing facilities, you must have perfect timing in coordinating construction schedules. For example, early in your construction planning you need basic drawings. Naturally, many of these drawings come from your suppliers. If they are tardy, you may have trouble meeting construction schedules.

At I-T-E we take a real interest in the solution of this customer problem. When you buy an I-T-E switchboard or unit substation, your order is placed well in advance of the shipping date. But we know that before you can install the equipment, floors must be poured, conduits provided for, and the channel base grouted in place. To do these things, you need certain switchgear drawings, and if you are like most of our customers, you want them quickly. Consequently, when your order is placed with I-T-E, the drawings you need quickly are prepared promptly. Result: you can complete your floor, spot your conduit and set in your channel base *on or ahead of construction schedules.*

—another reason why I-T-E is your best switchgear buy!

For further information on I-T-E Multumite Switchgear contact your local I-T-E representative or write to the I-T-E General Office.

I-T-E

R&IE

For *more dependable* Switchgear

—specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

cat nap's unaffected... his plant's protected

Here's real peace of mind! He knows that fire from a short circuit, a stray spark, a forgotten cigarette or spontaneous combustion can't destroy his investment in materials, equipment and buildings. His plant is protected with modern, approved C-O-TWO Fire Protection Equipment.

For instance, with a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System you have a 24 hour a day automatic fire watchman. The first whiff of smoke in a protected area sounds an alarm. Then fast, clean, non-damaging, non-conducting carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage . . . no lingering odors, no water damage with carbon dioxide.

There are areas in your plant that particularly need C-O-TWO fast, positive fire protection: record vaults, store rooms, spray booths, dip tanks, solvent baths, electrical equipment enclosures, lift trucks, pump rooms, especially anywhere there's danger of flammable liquid or electrical fires. The longer you wait to adequately protect these fire hazardous areas, the greater are the chances of a costly fire cutting into your profits.

Whatever your fire protection problem, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today . . . tell us about your particular fire hazards, our experience is at your disposal . . . no obligation of course.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

INDUSTRIAL BRIEFS

Repair Pit Lighting with fluorescent units recessed in pit walls eliminates extension cords and reduces lighting maintenance and explosion hazards at the Cleveland Transit System garage. The quality and quantity of vehicle maintenance has improved. Pit is 39 ft long and has 3 fixtures on one side and four on opposite side of pit staggered on 8-ft centers. Each unit has three 40-w white fluorescent lamps. Average illumination is 25 ft-c. Units are tilted slightly upward. Centers of units are 26 in. above floor. Design of installation was made by illuminating engineers of Cleveland Electric Illuminating Co and Westinghouse Lighting Div.

Continuous Casting Machine and mechanization of materials handling operations has increased output, bettered product and lowered costs at the Bristol Brass Corp, Bristol, Conn. This Rossi machine holds molten brass from several electric furnace heats in a molten reservoir at top level. The billets produced are more uniform and there is a substantial increase in output of induction electric melting furnaces because of elimination of delay in casting; saving in consumption of electricity and in labor by elimination of gates; lower zinc loss and mold cost.—Connecticut Light & Power Co.

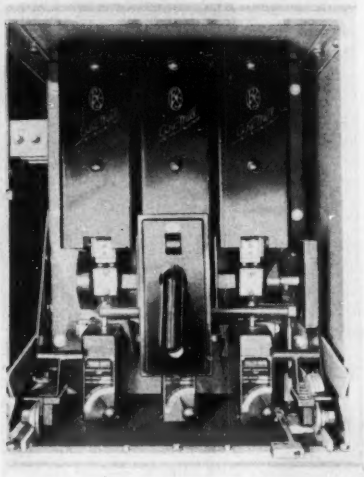
Salt Bath Wire Patenting at the Macwhyte Co, Kenosha, Wis., using an electric salt bath furnace has increased production from 800 lb of wire an hr to 2,000 to 2,500 lb and reduced cost of operation over former immersion type gas heaters.

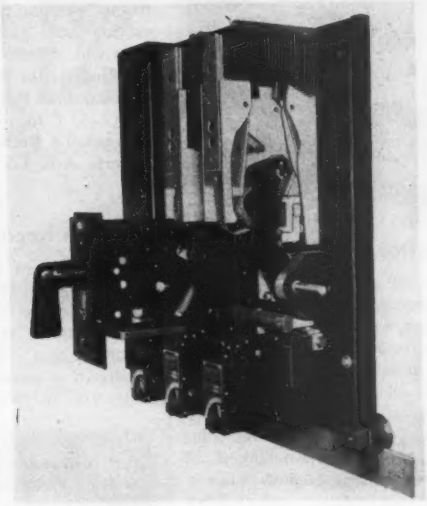
Chief Metallurgist, W. R. Bloxdorf reports "exceptionally high degree of temperature uniformity throughout the bath, excellent temperature control, ease of operation, low maintenance and low power consumption."

Rice Drying and Storing at an average rate of 100 bu per hr is aided by 21 motors of varying sizes used to drive fans, elevators, conveyors and other grain handling equipment at the Three G Grain Drier plant near Fairfield, Cal. Fans 10 ft in diam are powered by 20-hp motors. The modern and efficient materials handling methods reduce losses and hike production.

Our Complete Line
Contains the Answer to Your Electrical Equipment Needs

HERE ARE A FEW TYPICAL EXAMPLES . . .





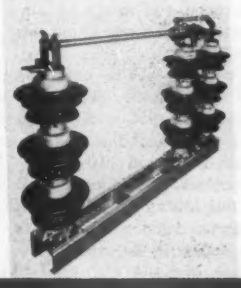
TYPE RS CIRCUIT BREAKER

The RS-25 Air Circuit Breaker was developed to protect feeder circuits in low voltage distribution systems. Dependability is a built-in feature of this ruggedly constructed breaker. Maintenance costs are low even under frequent operation. The RS-25 Breaker has a Standard Current Rating of 35 to 600 Amperes inclusive—Interrupting Rating of 25,000 Amperes.

WATTHOUR METER

Type S3 for Socket Mounting incorporates many improvements—new materials — techniques and refinements yet does not sacrifice principles of construction proven most desirable by long service performance.

SWITCHING EQUIPMENT



115 KV Duo-Roll Switch Features Rotary Linkage; High Pressure Contacts; Adjustable Insulator Pedestals; Non-Corrosive, Dry Type, Roller Bearings; Non-Corrosive Thrust Ball Bearing on Rotating Face of Cradle and Counter Balance.

ROLLER SMITH — Established 1908

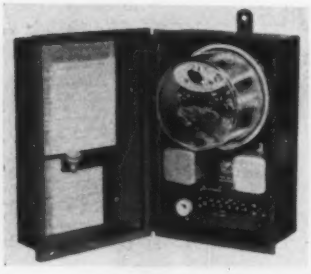
ROLLER-SMITH

ELPECO — Established 1910

BETHLEHEM, PENNSYLVANIA

Low Voltage Air Circuit Breakers • Power Circuit Breakers • Power Switching Equipment • Bus Supports And Fittings • Low Voltage Drawout Type Switchgear • Metal Clad Switchgear • Generator Leads And Station Bus Runs • Outdoor Sub Stations • Unit Sub Stations • Instruments • Watthour Meters • Relays • Rotary Switches • Precision Balances

NEW EQUIPMENT



Capacitor Switching Control

Banks of capacitors are automatically connected and disconnected from the system so as to give proper voltage control by use of the Type VSA voltage sensitive switch control and Type GR oil switches. While this control was originally designed for use with the Type GR switch, for either single or three-phase switching, it can be adapted to most solenoid or motor-driven circuit breakers and switches.

The control consists of a contact-making voltmeter, selector relays, and an adjustable time delay unit. Also provided are a fuse for control circuit protection, potential test terminals for connection of an external voltmeter, toggle switches providing manual control of the devices being controlled, and means for minimizing contact erosion and eliminating radio interference.

Operation of the control is from 120 v, 60 cycles. This power is obtained from the line to be controlled. Desired nominal line voltage can be adjusted between 110 v and 130 v. Recommended minimum band width for this instrument is three volts, the maximum band width is 12 v. Details appear in Bulletin 50021.

Line Material Co, Milwaukee 1, Wis.

•

Rectifier Cartridges

High-voltage selenium rectifier cartridges with voltage ratings up to 25,000 v per cartridge and current ratings to 75 ma can be applied to cable testing, condenser breakdown testing, cathode ray oscilloscopes, and electrostatic precipitators. Five different selenium cell sizes are used, varying from ⅛-in. diam to 1 in. diam with corresponding current ratings from 1.5 to 75 ma. They can be operated over the temperature range from −55 C to +100 C.

International Rectifier Corp, 6809 S. Victoria Ave, Los Angeles 43, Cal.

•

Two-Pen Recorder

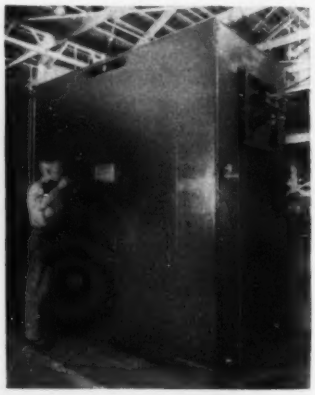
Two functions are simultaneously recorded against time by a new two-pen Speedomax electronic recorder. The instrument saves point-by-point plotting of data. Since both functions are drawn as continuous curves on a chart 9⅞ in. wide, swift-changing

variables can be followed with ease.

Two separate electronically-amplified measuring circuits, two balancing motors, and two recording pens are all housed in one standard case. Circuits can be supplied to work with thermocouples, Thermohms, strain gages, tachometers, thermal converters, or other types of primary elements.

Chart speed (the time axis) can be selected in the range of 1 to 1,800 in. per hr. Speed of response for full-scale pen movement is 3, 2, or 1 sec. To aid in identification, the instrument draws one curve in red ink, the other in black.

Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.



Dry-Type Transformer

Hermetically sealed dry-type transformers with Class B insulation permit a price just 10% higher than conventional open-type units, instead of the 20% figure for transformers with Class H insulation. Extensive tests are reported to show that Class B materials in a nitrogen atmosphere can be satisfactorily operated at the 180 C temperature previously assigned only to Class H materials.

They can be installed either outdoors where there is no exposure to lightning, or indoors. Underground installation is permissible even where moisture, dust, lint, or corrosive fumes are present. Because they are nitrogen filled, installation indoors does not require a fireproof vault.

The units are available in ratings through 1,500 kva and 15,000 v. They can be supplied with metal-clad switchgear for load center installations or with network protector and high-voltage switch as a completely equipped network unit. Further details will be in Electrical World, Feb. 12.

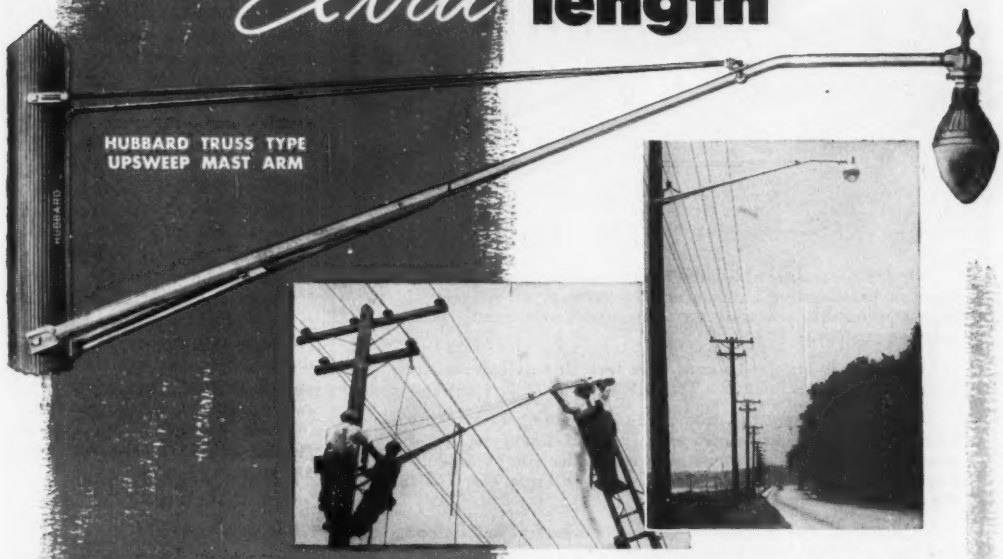
General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•

Industrial Oven

Electric heater panels and standardized frame members compose a new type industrial oven. By using rod-

Extra strength ... for *Extra* length



CHECK THESE ADVANTAGES

- ✓ Exceptional strength . . . four-way triangular truss arrangement.
- ✓ Require small pole mounting space.
- ✓ Meet all EEI-NEMA specifications.
- ✓ Simplicity of design means low cost.
- ✓ "Free flowing" internal wiring — beveled pipe ends — no sharp bends — no obstructions.

Hubbard Truss Type Upsweep Mast Arms embody the features which Hubbard has pioneered in other members of the "Upsweep" arms and brackets. In the three years since their introduction they have received wide acceptance with the Electrical Industry because of the special and desirable features which they possess.

The No. 3944 series has exceptional strength in all sizes, greatly in excess of the most severe service requirements. Six-inch threads at both ends of supporting rods provide leveling and lift adjustment. The Arms may be used with internal or external wiring.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

CRESCENT ENDURITE
DUAL PURPOSE WIRE & CABLE

Listed by Underwriters' Laboratories as
TYPE RH- 75° C
OR
TYPE RW- 60° C

In DRY locations ENDURITE insulated wire and cable with its superior heat-resisting characteristics, is rated as a Type RH with higher permissible operating temperature and consequently greater carrying capacity.

In WET locations this same wire with its excellent moisture-resisting qualities is rated as a Type RW.

Except where voltage drop is the determining factor, CRESCENT ENDURITE when used as a Type RH allows the use of a smaller size of cable and in many cases smaller size of conduit at less cost than would be required for Type R or Types T or TW for the same load.

Usually in sizes No. 6 A.W.G. and heavier for power circuits and No. 1 A.W.G. and heavier for lighting circuits CRESCENT ENDURITE as TYPE RH will give the lowest cost per ampere of useful circuit capacity.

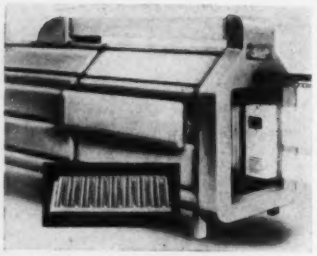
For branch circuits requiring small size conductors, Voltage Drop is the determining factor in the choice of conductor size.

There is also a definite advantage to you in the REDUCTION OF STOCKS as this one wire will meet all your building wire requirements for both the usual dry location and the occasional wet location.

Send for Bulletin giving Comparative Current-Carrying Information

CRESCENT
WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.



type heaters mounted on insulated oven wall sections, radiant heating is combined with temperature-controlled convection for industrial heating and drying operations up to 700 F.

Ovens of any size, shape, and heat capacity can be field-assembled from standard parts. When equipped with approved controls and ventilation, these ovens comply with latest industrial oven standards.

From 4 to 40 kw for heating may be installed in each Advance 26x84-in. panel. Because of this broad range of heating, the panels may be used for ordnance, aircraft, and many other types of production. To increase the output of continuous-type ovens and driers now in use, whether they are electric or not, these heater panels can be added at the entrance end.

Jensen Specialties, Inc, Advance Heating Div, 9331 Freeland, Detroit 28, Mich.

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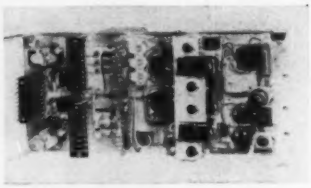


Carrier Telephone System

A medium-haul carrier telephone system, called the FTR 9-H-2, has been designed for utilities and independent telephone companies for operation over distances where the long-haul system would be economically impractical.

Single-sideband transmission is employed in the system which is stackable to three channels and will operate on open telephone wire over distances ranging up to 225 miles. Signal receiving circuit of the 9-H-2 system has been designed to make it less sensitive to pulse ratio variations.

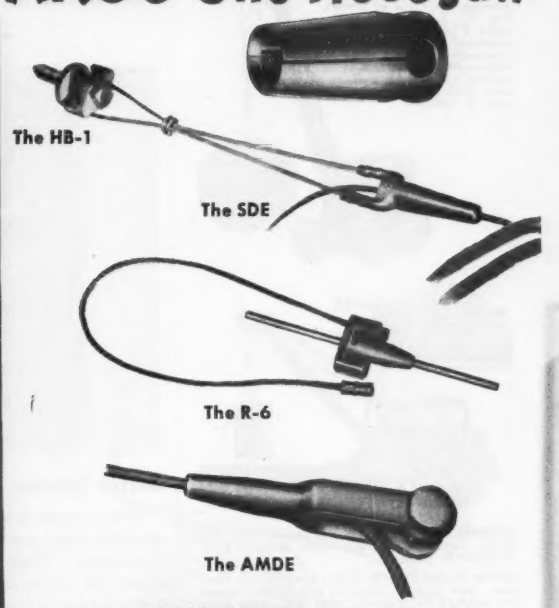
In addition to its use on open-wire

All FARGO Service Cable Dead Ends Have the Exclusive FARGO One-Piece Jaw

Perfectly Aligned for Better Gripping

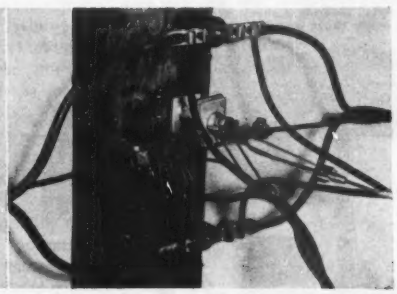
Here you see three Fargo Service Cable Dead Ends — each equipped with the exclusive . . . perfectly aligned Fargo One-Piece Jaw that makes for greater ease of installation — and better gripping.

THE SDE, available in sizes from 8 to 2 solid, provides the ideal means of fastening the messenger of self-supporting service drop cable to a Fargo HB-1 House Bracket, or secondary rack. *THE R-6*, in sizes to accommodate 8 and 6 solid, is designed with one end of the bail removable from the gripping unit to facilitate quick, permanent installations, and is installed simply by threading the detached end of the bail through the house bracket or rack. *THE AMDE* is similar to the SDE and *R-6*, except that it is of the clevis type for attachment to an eye bolt, or equivalent. If desired, all three types may be obtained with plated jaws for use on aluminum conductors.



Tapping 1 to 4 Services from Self-Supporting Secondary Cable

The photo, at the right, shows the new Fargo method of tapping 1 to 4 services from self-supporting secondary cable. It involves cutting the two hot legs at a point corresponding to the center of the pole. The hot legs are then fanned out and the bus on the multiple-tap bracket is made just long enough (approx. 7") to give required spacing. In making the installation, we suggest that all hardware on the messenger be left bare, but that the multiple tap be left taped. Your Line Material sales representative will be glad to give you complete details.



FARGO CONNECTORS

Fargo Connectors are built like a bench vise and clamp on wires as effectively. Because there are no threads to start — or parts to disengage on installation — they are a real time saver for the linesman . . . make his job safer! Electrically, they make a good low resistance connection at a cost no more than ordinary types.

..."built like a vise—grip like a vise."

FARGO

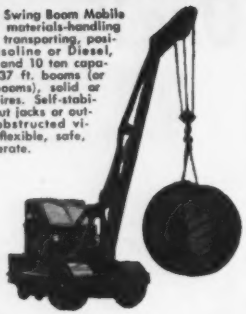
Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N.Y.

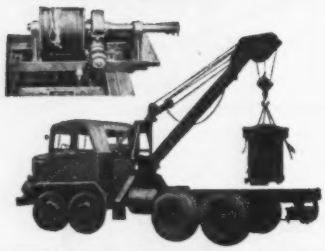
Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM®

Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing Boom Mobile Cranes: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.





WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

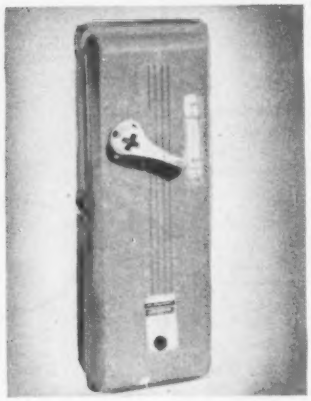
WRITE FOR CATALOGS:
No. 79—*KRANE KAR* No. 70—*Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
867 83rd ST., BROOKLYN 20, NEW YORK

lines, it may be applied to broad-band radio links of stable characteristics. The channels are also suitable for operation of multi-channel voice-frequency carrier telegraph systems operating in the 300 to 2,700-cycle range.

Federal Telephone and Radio Corp, 100 Kingsland Rd, Clifton, N. J.

•



Motor Starter

Motor starter, motor protection, and and disconnect are combined in Life-Line-starter Class 11-206-N. Designed for across-the-line starting of squirrel cage induction motors, or as a primary switch for wound rotor motors, this unit also features the AB De-ion circuit breaker and slamproof self-indicating interlocked handle.

Starter component operates with the action of a see-saw pivoted on a knife-edge bearing with kick-out spring for positive opening. It is intended for use with up to three safety padlocks. Slamproof handle is also interlocked to prevent opening of the enclosure when breaker is closed. Capacities are available from ¼ to 100 hp, 110 to 600 v polyphase, NEMA sizes 0 through 4, and enclosures 1, 1A, 3, 4, 5, 7, and 9.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

•

Splice Caps

New open-end splice caps for "pig-tail" splicing of electrical wires insure that wire insulation is always flush with the splice cap. It also insures that wires are always inserted to the full depth of the splice cap for maximum joint efficiency.

Only two sizes of splice caps are required for the most frequently used combinations of two or more wires ranging from two No. 18 to three No. 8. Quickly applied snap-on insulators of fixed insulating value eliminate need for taping of joints and insure against insulation breakdown in service. Both sizes may be installed with the hand-operated "pres-SURE-tool."

Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J.

•

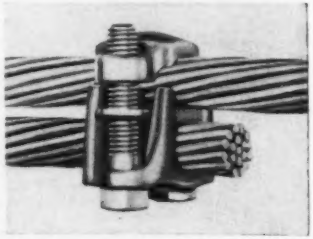
Motor Starter Pushbutton

For motor starters and lighting circuits, Type EO pushbutton for Class I, Group D hazardous locations is equipped for conduit entrance at either top or bottom. No angular fittings are needed.

This pushbutton may be used as air-break or with contacts oil-immersed. A screwed-on tank forms the bottom half for quick access to interior connections. Bulletin 1105-C gives ratings, dimensions and additional details.

The Electric Controller & Mfg Co, 2700 E. 79th St, Cleveland 4, Ohio

•



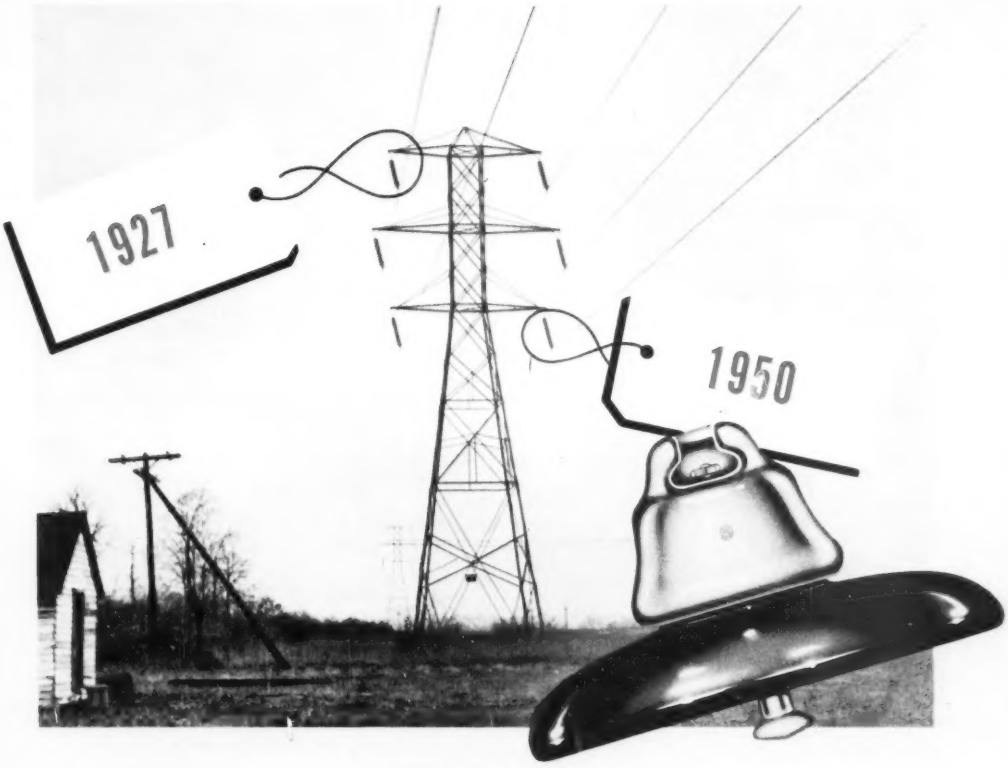
Line Clamps

Two series of two-bolt, one-piece line clamps compensate or flex as the conductor increases or decreases with the rise and fall of conductor and/or ambient temperatures. The series are known as K and KR line clamps. They differ only in one respect: Type KR incorporates a spacer bar and type K does not. Type K is adequate for most applications. Type KR, because of the spacer bar, provides better current distribution among the strands and so provides higher conductor utilization and circuit security especially when fault currents are severe, company reports.

The upper and lower clamping members are cast of a special high

(*Continued on page* 191)

HI-TENSION NEWS *Junior*



YOU CAN'T *Talk 'em* INTO THIS!

● 1927 to 1950 -- 23 years -- separate the first and second circuits of this 138-kv line. Circuit Number One was built with O-B suspension insulators. At that time, engineers might have asked, "How good are these insulators?". But, when 1950 rolled around, the question had been answered adequately and O-B's were put on the second circuit. Nothing we might say could have influenced this choice -- it was based purely on experience.

Most O-B insulators are bought this way. Mere conversation can't change a power company's own records. And such records in thousands of engineering departments are the most conclusive proof you can find of O-B's long-time satisfaction.

For suspension insulators you can install and then forget -- until you want more -- specify O-B!

Ohio Brass

MANSFIELD, OHIO, U. S. A.

(B)

HI-TENSION NEWS *Junior*

Keep it Quiet

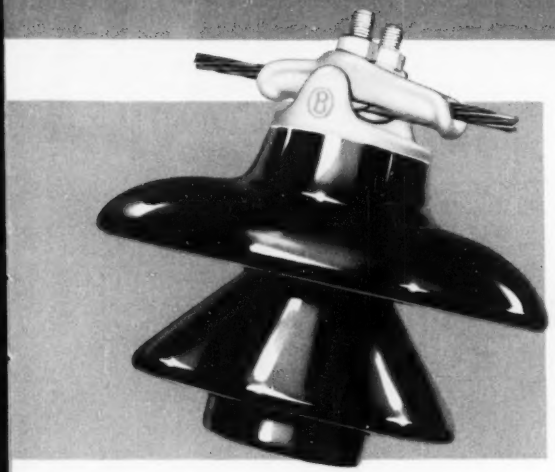
Tie Wires Cause a Lot of Radio Noise— End it With O-B Clamptops

● Loose tie wires are one big cause of radio interference in a power line. Even if installed tight, wind, ice, and mere time will loosen the average tie. You can't be sure of radio-silence by any trick insulator design, because it's not the insulator, it's the tie wire! But you *can* replace these troublesome ties with a clamp that goes on the wire easily, and stays there. This is the O-B Clamptop insulator. It is as tight as the best hand-served tie and never lets go. Lines on O-B Clamptops start quiet, and stay quiet. This excellent insulator design will stop a lot of trouble calls.

Two Days—

The First and the Last . . . Measure Your Station Insulator's Dollar's-Worth

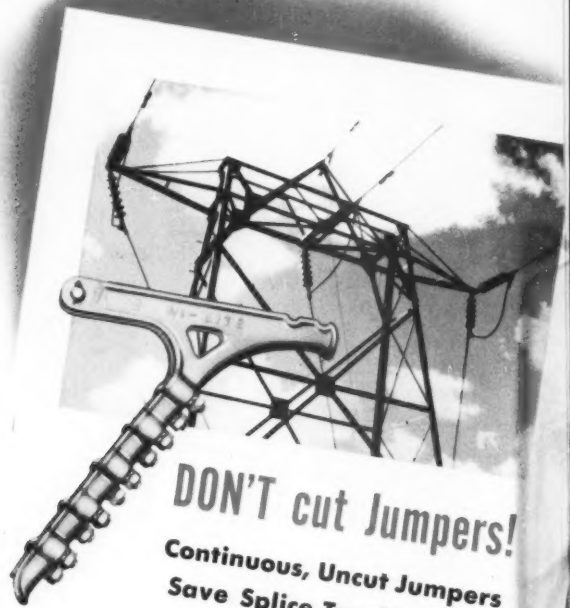
● Station insulator standards and specifications apply to the "as manufactured" condition -- the first day of an insulator's life. Performance is measured on the last day. Don't confuse these two days or it may cost you money! Your biggest dollar's worth is gauged by how far apart these two days can be. Thousands of O-B station insulators have seen some 35 years of service with that last day nowhere yet in sight. They have already proved to be a good investment -- and one that is still appreciating. With an eye to that important "last day," put it off by specifying O-B station insulators.



Tolerance—

Is DEDUCTED From Lightning Arrester Protection. That's Why We Keep it Small

● Lightning arrester operating tolerance is *added to* average published ratings in evaluating usable protection. But, there's another way of looking at this -- in adding tolerance to average values, you are deducting it at the same time from protective margins. Condition of older apparatus may possibly not leave too much of this margin to spare. The less you must sacrifice for tolerance, the better. O-B Thorex lightning arresters have, by far, the closest tolerances in both sparkover and IR discharge ever offered on the American market. This fact justifies your serious investigation.



DON'T cut Jumpers!

Continuous, Uncut Jumpers Save Splice Troubles and Construction Costs

● Conductor cable can be carried straight through strain points when you build with O-B Hi-Lite strain clamps. Jumpers are formed in the continuous cable -- splices eliminated -- and with them goes a lot of potential trouble. No special tools, equipment, or skill are needed. Clamps start at comparatively low cost and accumulate further savings in the form of construction time. It adds up to a sizable economy. For less money you can get a better job and a more trouble-free line when you build with O-B strain clamps.

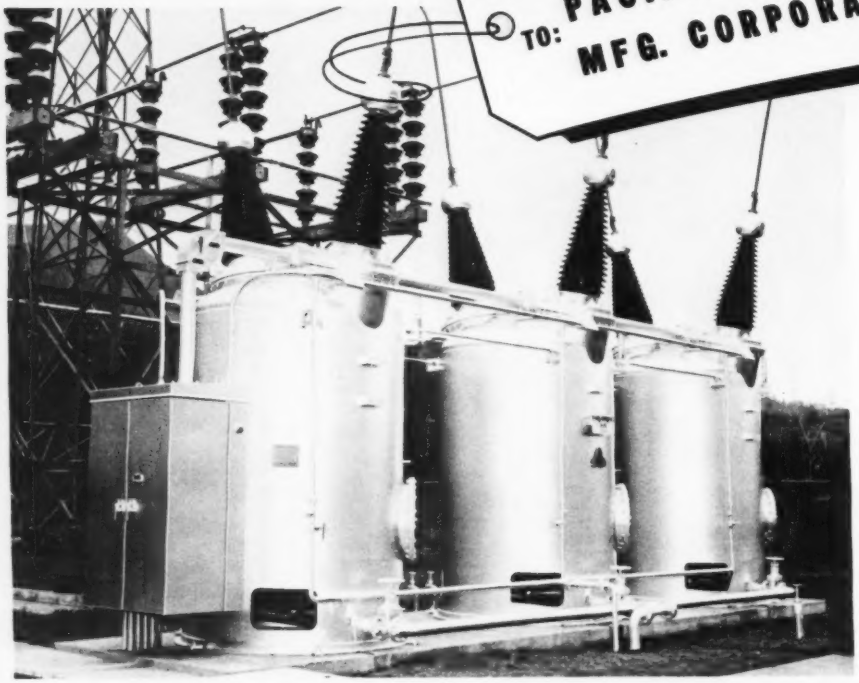
Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

OHIO BRASS COMPANY
BARBERTON DIVISION : BARBERTON, OHIO, U.S.A.

TO: PACIFIC ELECTRIC MFG. CORPORATION



● One of several three-phase oil circuit breakers supplied to a large Western system by the Pacific Electric Mfg. Corporation. According to the apparatus builder . . . "These breakers are designed for operation on 230-kv lines, have an interrupting capacity of 7,500,000 kva, and carry 1200 amperes continuously. Interrupting time is 3 cycles, closing time 10 cycles, and reclosing time is adjustable as desired from 15 to 45 cycles. Sliding-shoe contacts require no critical adjustment to fix closed position, nor is contact pressure affected by contact wear. Other Pacific Electric features include closing by stored energy of motor-compressed springs, improved arc extinguishment." And . . .

BUSHINGS

one of the finest components of any circuit breaker-

Ohio Brass

MANSFIELD, OHIO, U.S.A.

4112-H

New Equipment

(*Continued from page* 186)

strength copper alloy which was chosen because of its flexing characteristics. The conductor spacer bar is cast of a high conductivity copper alloy. Bolts are of high grade silicon bronze and, in design, are considered solely as stress members and not as current paths. Seven sizes in each series cover the range of connecting a No. 4 or a 1,000-Mcm main to No. 8 or 1,000-Mcm tap.

Anderson Brass Works, Inc, P. O. Drawer 2151, Birmingham 1, Ala.

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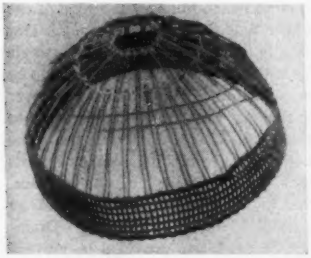


Heating System

A new heating system can be woven into flexible tapes, cylinders, spheres, and various odd shapes. The element is dimensionally so thin that it requires so little space as to make unnecessary the designing of the apparatus around the heating element. Instead, the heating element can be fitted in after the apparatus has been designed. Suggested applications of the system include pre-heating, de-icing, or anti-icing.

Nylon reinforced cords, spun glass, and silicone insulating coverings are used in conjunction with various methods of circuiting. The heating elements operate in the infrared range at densities of 15 w per sq ft to 15 w per sq in. The heating unit illustrated is meant for installation on the outside of a metal dome.

Electroweave Mfg Co, Inc, 30 Rockefeller Plaza, New York 20, N. Y.

•

Transformer Cover Clamp

A new method of fastening cover to transformer tank, and use of inhibited oil, are two new features of the line of Form W distribution transformers. The Shur-Seal cover clamp

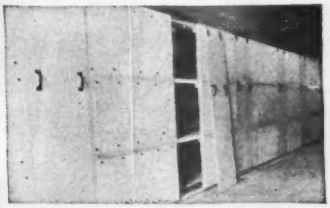
SOLVE YOUR HIGH-VOLTAGE ELECTRICAL-EQUIPMENT HOUSING PROBLEM

-with Trancell Materials

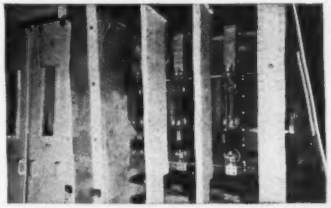
You'll find—as others have—that it is easy, fast, safe, and economical to use Johns-Manville Trancell for solving the problem of equipment housing in your station expansion program . . . and you'll find, too, that Trancell Materials make a smart, efficient-looking station.

Faster to install — Trancell cuts easily, and can be quickly drilled right on the job with regular tools.

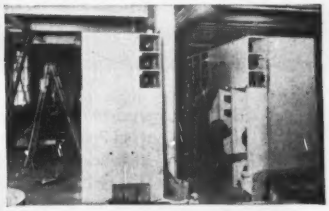
Easier to install—Trancell's light weight and strength make it easy to handle, easy to mount without framework.



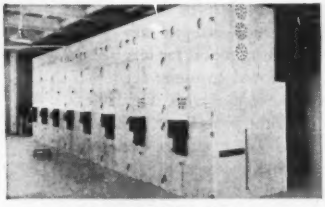
Safer to install—Trancell is a non-metallic asbestos-base material . . . installed dry. It adequately isolates high-voltage equipment from fire and excessive heat.



Economical to install — Trancell's ease of fabrication and installation keep station expansion and future maintenance costs down.



Attractive when installed — Trancell makes up into neat, attractive, flush-type housings, panels, doors, and partitions that require no painting.



—for all high voltage power equipment enclosures — Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions, bus bar enclosures, and other electrical services. For further information write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville

TRANCELL

an asbestos product for housing electrical equipment

"Make it a **KOPPERS POLE** . . . I want it to <u>last</u>!"

IT'S easy to appreciate this art-lover's attitude. Like all linemen, he thinks of Koppers Poles in terms of permanency.

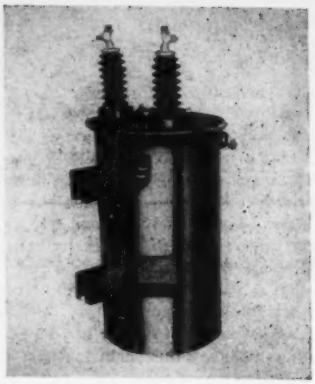
Koppers Poles *do* last. Not just for years—but for decades. By retaining their strength, these poles provide exceptionally long periods of *uninterrupted* service. This, in turn, means far less maintenance work . . . more revenue . . . improved customer relations.

Koppers is the kind of company you like to deal with. Deliveries are made on schedule. The high quality of the poles is constant. All transactions are on a businesslike basis. These factors definitely make your line operation easier and more economical.

The next time you're in the market for poles, let us give you our quotation. Koppers Full-Length Pressure-Creosoted Poles can be delivered from any of our many conveniently-located treating plants.

KOPPERS COMPANY, INC. PITTSBURGH 19, PA.

KOPPERS PRESSURE-TREATED WOOD



consists of a ring of V-shaped cross section which fits over the edge of the cover and the lip of the tank. This ring is tightened by means of a single bolt; the pressure it exerts is said to be equal at all points so that the cover gasket is uniformly compressed to form a positive seal between the cover and lip of the tank. Company reports that no "breathing" can take place, and there is no danger of oil leakage during shipment or handling. Drainage channels are provided to prevent water from accumulating on the transformer cover.

The inhibited oil reduces oxidation to retard formation of acids, sludge, etc.

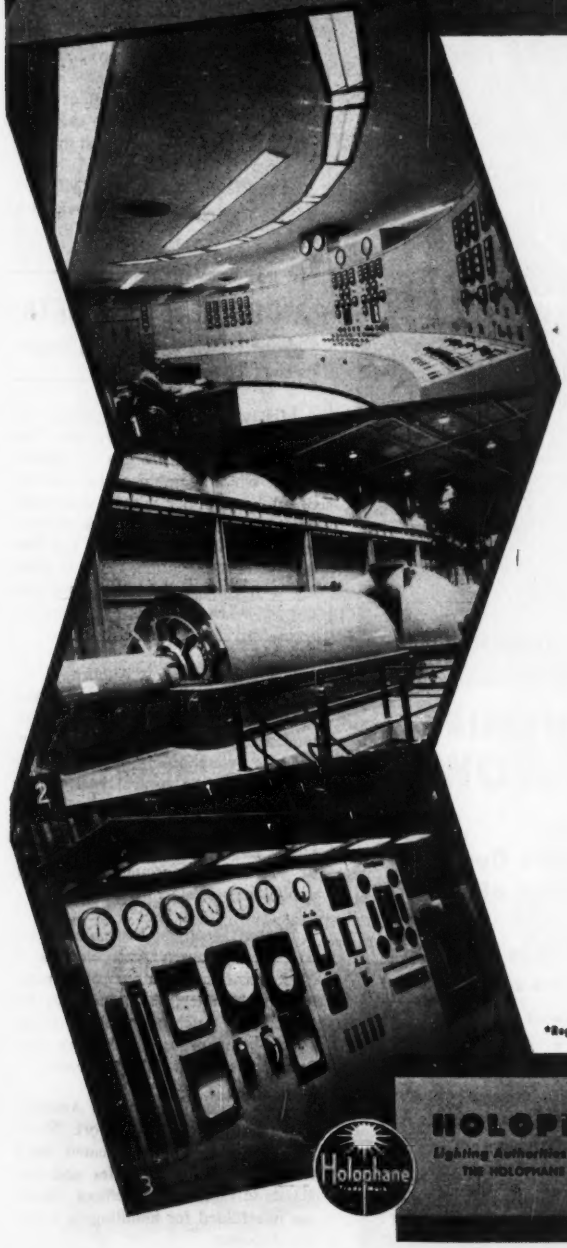
Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo.

•

Cable Hoist

Total enclosure of the motor within the cable drum is featured in a new line of electric cable hoists. This is claimed to reduce over-all dimensions and afford substantial weight savings. Also, due to the enclosed hoist design, motors are protected against moisture,

HOLOPHANE . . . Lighting for GENERATING STATIONS . . . through three eyes



The recently completed Alexandria, Va. Generating Station of the Potomac Electric Power Co.—(STONE and WEBSTER, Engineers and Constructors), is an outstanding example of new Holophane Lighting Equipment for Generating Stations.

1. Control Room showing the use of In-Bilt HOLOFLUX* Fluorescent CONTROLENS*
2. Turbine Room effectively illuminated by Holophane HIBAY* units
3. Turbine Board with canopy housing Holophane incandescent CONTROLENS

Holophane Engineers have kept abreast of the trends in design and construction. New techniques are continually developed to meet all practical requirements for specialized lighting equipment. Holophane Engineering Service is offered, without charge or obligation, to consulting engineers for modernization, addition or new generating plant lighting including:

- Coal handling, conditioning and ash disposal
- Turbine rooms
- Boiler plants
- Boiler and turbine control boards
- Control rooms, electrical and mechanical
- Dispatch boards
- Switch yards and outdoor substations
- Gate house
- Outdoor lighting of plant property

Write for latest Holophane Engineering data on Generating Station Lighting

*Reg. U. S. Pat. Off.

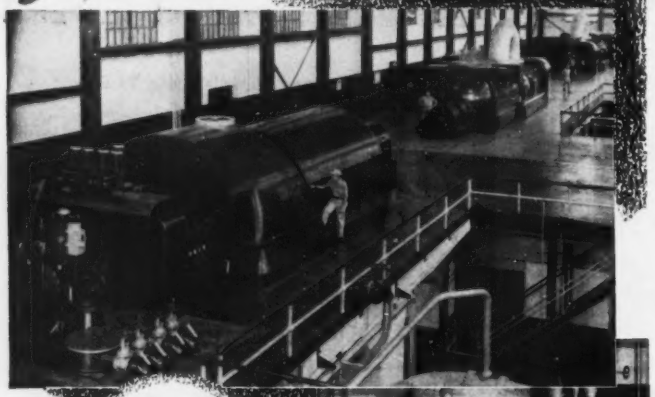
Holophane

HOLOPHANE COMPANY, INC.

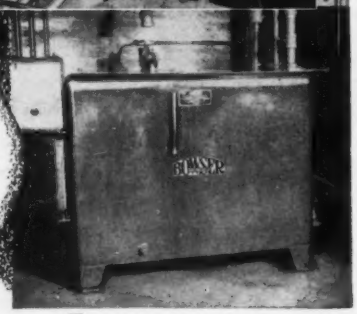
Lighting Authorities Since 1898 • 342 MADISON AVENUE, NEW YORK 17, N. Y.

THE HOLOPHANE COMPANY, LTD., THE QUEENSWAY, TORONTO 9, ONT.

Longer life for Turbine Bearings



The bearings of these 40,000 KW turbine generators are insured against bearing failure by Bowser oil conditioners.



Stop THESE 6 ENEMIES OF TURBINE OIL NOW....

1. Turbulence
2. Air Entrainment
3. Moisture Contact
4. Heat
5. Metallic Contact
6. Removal of Inhibitors

When turbine bearings "stay-on-the-job," costly shutdowns are avoided and less standby equipment is required.

• • •

Write today for your copy of this new bulletin on the improved Bowser method for conditioning turbine oils.

BOWSER, INC., 1384 Creighton Avenue, Fort Wayne 2, Ind.

LIQUID CONTROL SPECIALISTS SINCE 1885

splashing liquids, weather, dust, and corrosive atmospheres.

Load-lifting and carrying parts of this Bob-Cat line are made of steel forgings and castings. Load hook oscillates on ball bearings and swivels on roller bearings. It is suspended on a 5/16-in. pre-formed plow-steel cable. Capacities of ½, 1, 1½, 2, 3, and 5 tons are available. They are designed for operation on 220, 380, 440, or 550 v, 3-phase, 60 cycles, either pendant rope control or push-button control on pendant cable. A transformer reduces voltage at the control to 110 v.

The Cleveland Chain & Mfg Co, Broadway and Henry St, Cleveland 5, Ohio

MORE NEW PRODUCTS about which you should know

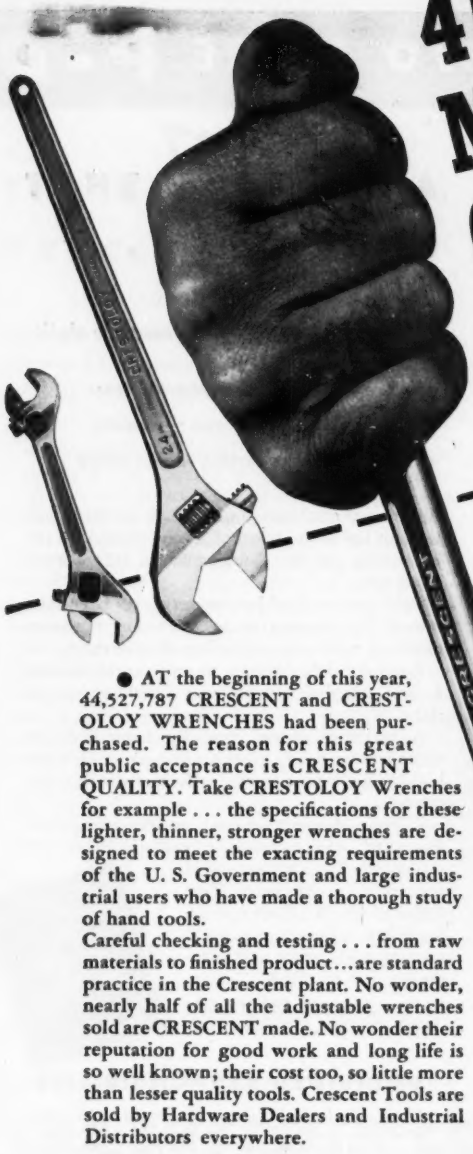
Mallasch-Brandt Engineering Co, Dept O, 1032 N. Orange Drive, Los Angeles 38, Cal., offers a **fishtape puller** which combines the conventional hand puller with a detachable pressurized puller for more difficult jobs. . . . Nite-Tel-Lite, Inc, 514 Second St, S. W., Canton, Ohio, is making a **telephone light** that spotlights the dial when phone-user picks up the receiver; 115 v ac or dc.

Gleason-Avery, Inc, Auburn, N. Y., has adapted its damper **control motor** to closing windows of a small unattended greenhouse, poultry farm, produce warehouse, or other use where automatic control is necessary in case of power failure. . . . Jack & Heintz Precision Industries, Cleveland, Ohio, is producing a 500-amp, 30-v dc **generator** for ground use in such applications as starting jet engines.

Weston Electrical Instrument Corp 614 Frelinghuysen Ave, Newark 5, N. J., has designed a recording **speed-ratio tachometer** which indicates the percentage stretch or shrinkage of materials being processed through pairs of rolls turning at different speeds.

The Silicone Paper Co of America, Inc, 230 Park Ave, New York, N. Y., is marketing a silicone-treated tissue for **cleaning safety goggles** and eyeglasses in factories and offices. Sheets are interfolded for handling in a simple dispenser.

45 MILLION CRESCENT WRENCHES!

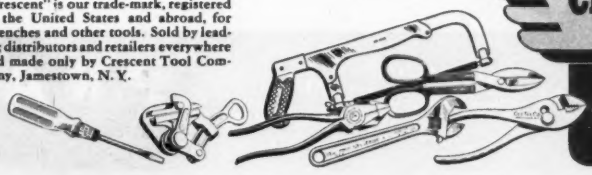


● AT the beginning of this year, 44,527,787 CRESCENT and CRESTOLOY WRENCHES had been purchased. The reason for this great public acceptance is CRESCENT QUALITY. Take CRESTOLOY Wrenches for example . . . the specifications for these lighter, thinner, stronger wrenches are designed to meet the exacting requirements of the U. S. Government and large industrial users who have made a thorough study of hand tools.

Careful checking and testing . . . from raw materials to finished product...are standard practice in the Crescent plant. No wonder, nearly half of all the adjustable wrenches sold are CRESCENT made. No wonder their reputation for good work and long life is so well known; their cost too, so little more than lesser quality tools. Crescent Tools are sold by Hardware Dealers and Industrial Distributors everywhere.

CRESCENT TOOL COMPANY, Jamestown, N. Y.

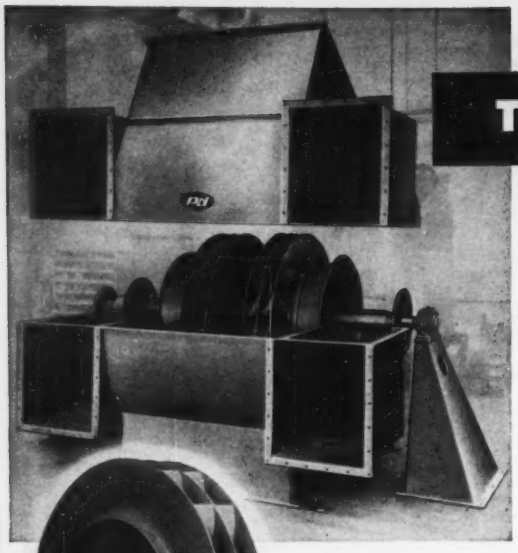
"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.

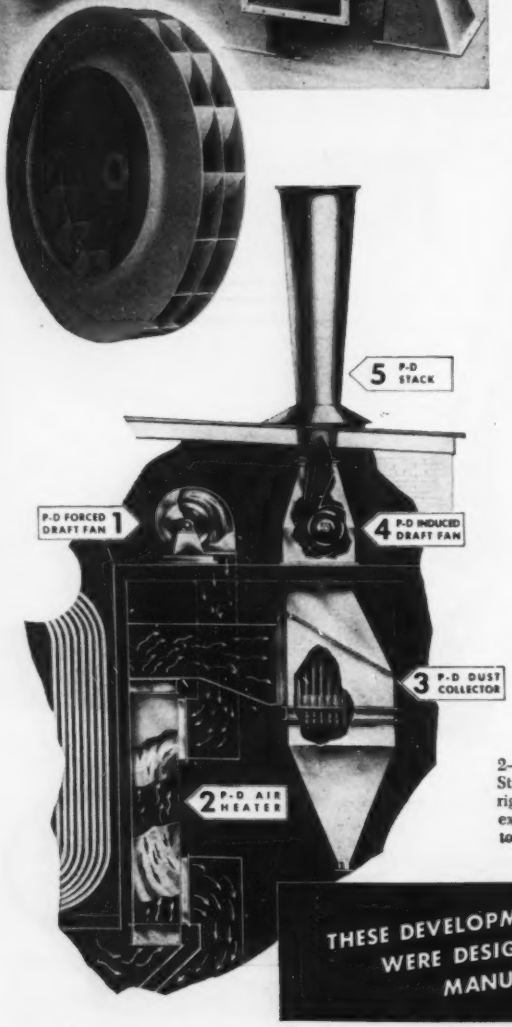


CRESCENT TOOLS

Sign of the Artisan
Symbol of Excellence

TWO MORE P-D





AN F-D FAN THAT PROVIDES 1 . . .

- *Transfer of more kinetic energy to static pressure*
- *More effective aerodynamic flow*
- *Lower horsepower requirements*
- *Appreciable reduction in fan noise*

An unusual combination of research facilities, and the best fan design talent of several countries,* are responsible for the development of P-D Forced Draft fan.

Peak efficiency and horsepower curves fall within normal fan selection ranges, providing optimum efficiency with non-overloading characteristics.

Improved diffusion from wheel to outlet permits a more complete conversion of kinetic energy to static pressure.

A backward curved, specially designed blade offers a more nearly perfect aerodynamic flow on both the leading and trailing surfaces, reducing eddy currents.

A larger, deeper inlet cone provides a smoother flow at the inlet, increasing over-all efficiency.

This new fan has been tested according to Standard Test Codes of the N.A.F.M. and the A.S.H.V.E. Write our project and sales engineers for the new bulletin No. *300* on this F. D. Fan.

*Prat-Daniel Experimental Laboratories, East Port Chester, Conn., The Bahco Fan Works in Sweden, Prat-Daniel (Stanmore) Ltd., in Great Britain and Societe Prat-Daniel of France.

UNDIVIDED RESPONSIBILITY

The illustration at left shows the 5 major boiler plant auxiliaries now built by Prat-Daniel; 1—F-D Fans, 2—Air Heaters, 3—Dust Collectors, 4—I-D Fans and 5—Fan Stacks. . . . In short, the equipment to handle the air-gas stream right through the plant, may now be purchased from a single experienced source, with the economies and advantages inherent to such responsibility.

THESE DEVELOPMENTS WERE DESIGNED AND MANUFACTURED BY: **PRAT-**

CONTRIBUTIONS TO EFFICIENCY

THE DECANTATION PROCESS . . .

A single stage, P-D Tubular Dust Collector, arranged to permit re-firing of high carbon dust without total re-circulation of flyash.

The well-known law, based on the inertia of a mass traveling at high velocities, suggested the design of an apparatus for separating large particles of high carbon content from flyash, for re-injection.

This is accomplished in a *single unit* by the P-D process of Decantation.* As the word implies, this collector literally pours off the larger particles into a hopper for re-firing, permitting the finer particles to enter the P-D tubes for precipitation and disposal, as shown in the illustration. Tests have proven that up to 40% of flyash from spreader stokers is generally suitable for re-injection. To obtain the best results from re-injection, and prevent the non-combustible particles from overloading, causing erosion and poor combustion, it is desirable that these particles be removed from the system.

Cut at lower right shows the space this P-D Decantation Collector requires in comparison with a standard unit. The Decantation unit actually occupies *less* area, (slightly more height), requires no more draft than is necessary to operate a standard tubular collector.

Our Project Engineers will be glad to send you this latest Bulletin No. 260D describing this apparatus.

*Pat. applied for.

Comparative size

PROJECT AND SALES ENGINEERS

THE THERMIX CORPORATION

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DANIEL CORPORATION

EAST PORT CHESTER, CONN.

NEWS ABOUT PEOPLE

GE Names Managers of Apparatus Divisions

John W. Belanger and Nicholas M. DuChemin, assistant general managers of General Electric Co's Apparatus Department, have been made general managers of the Large and Small Apparatus Divisions, respectively.

The appointments mark an integration of the department into three basic units, the Large Apparatus Divisions, the Small Apparatus Divisions, and the Marketing Divisions. Belanger and DuChemin will be responsible to Henry V. Erben, vice president. Marketing operations will continue under Chester H. Lang, vice president and manager of marketing for the department.

Belanger joined GE in 1917 as a student engineer at the Lynn, Mass., Works. He held positions in the Power and Mining Department in Schenectady, N. Y., in the arc welding field; in the Philadelphia sales office as an arc welding specialist; in the Philadelphia office industrial department as a salesman contacting steel mills and oil refineries; and as head of marine sales for the Philadelphia district.

JOHN W. BELANGER

He returned to Schenectady in 1940 as assistant manager of the Federal and Marine Divisions and in 1943 became manager of these divisions. He was appointed Apparatus Department assistant sales manager in 1945, manager of the Turbine Divisions in 1947, and assistant general manager of the Apparatus Department in 1949.

N. M. DuCHEMIN

DuChemin started at the Lynn River Works in 1914 and returned there after World War I naval service to work in the turbine department. He was made general superintendent of the West Lynn Works in 1923, becoming one of the youngest executives in the company.

In 1935 DuChemin was appointed assistant works manager, in 1942 acting manager, and in 1943 works manager. He was named manager of the Meter and Instrument Divisions in 1947 and an assistant general manager of General Electric Apparatus Department in 1949.

•

Logan Named Director of L. A. Electric League

New managing director of the Electric League of Los Angeles is Glen L. Logan. He succeeds William J. Quinn who has retired.

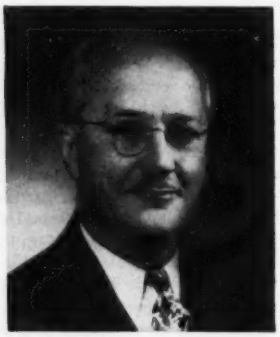
Logan has been associated for many years in a sales capacity with the auto industry. He worked for Packard Motor Car Co for 16 years and at one time served as executive assistant to the vice president in charge of sales. He later joined Kaiser-Frazer Corp as eastern sales director.

During World War II Logan worked for the War Production Board coordinating a materials conservation program in major industries in the Eastern section of the country.

Sheldon Named President of Kennecott Wire & Cable

Alan F. Sheldon has been elected president of Kennecott Wire & Cable Co, a subsidiary of Kennecott Copper Corp, to succeed Robert L. Coe who has retired.

Sheldon has been associated with Kennecott companies since 1929. He began in the sales promotion department of Chase Brass & Copper Co and became manager of the department in 1937. In 1940 he was appointed vice president and general manager of Kennecott Wire & Cable.



A. F. SHELDON

Prior to 1929, Sheldon was with the Mueller Brass Co at Port Huron, Mich., and later at Pittsburgh, Pa.

He is a vice president of the National Electrical Manufacturers Association and a director of the National Metal Trades Association of Rhode Island.

•

Atom Power Appointments Bring Westinghouse Shifts

Several personnel changes at Westinghouse Electric Corp have followed new appointments in the company's Atomic Power Division.

Dr Charles M. Slack, formerly technical director, has been named assistant manager of the division. He will serve as consultant to the manager and to the technical management on research and engineering problems.

the industrial monkey

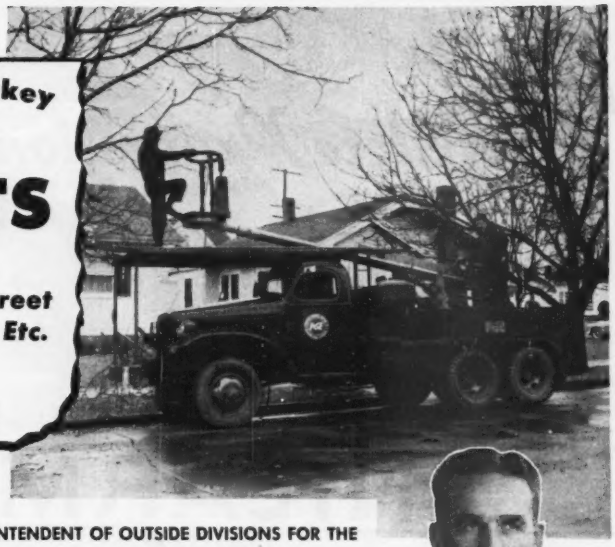
CUTS COSTS

FOR P.G.E.

Tree-Trimming • Street Light Maintenance Etc.

Cut

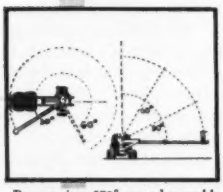
1/3 TO 1/2



SAM PEARSON, SUPERINTENDENT OF OUTSIDE DIVISIONS FOR THE Portland General Electric Company REPORTS: "Based on six months experience with one machine, we estimate our saving on tree trimming and street light maintenance will be one-third to one-half our previous cost. *In addition this equipment is invaluable for many difficult repair jobs.* We now have six machines and another one on order."

Closeup shows how worker presses buttons with feet. Guard rail protects worker all around.

Cab controls may be mounted as shown or on extensible unit.



Boom swings 270° around turntable —30° to left front—60° on left rear. *Worker can cover approximately 1200 foot area without moving truck!* Cage on boom lifts worker to reach a height of 40 feet.

MORE RESULTS WITH LESS MANPOWER

Constantly higher costs are the growing shadows that accompany your workmen when they go above ground. CUT COSTS with INDUSTRIAL MONKEY, the labor-saving development that makes..."pole-climbing and ladders obsolete to 40 feet!"

DUAL CONTROLS . . . Worker on platform has complete control without use of hands. Also complete duplicate set of controls in cab.

FAST . . . Hydraulic boom elevates from horizonal to vertical in approximately 20 seconds. Speed is adjustable.

SAFE . . . Four-to-one safety factor for a 200-lb. worker *at any position.* Four-to-one factor with 1200 lbs. in many positions!

INSULATION . . . cage tested to 24,000 volts without leakage.

POWER . . . May be independent or from truck take-off.

FIXED AIR LINES . . . extend up boom to easy-access outlets for pneumatic tools on working platform.

ROAD CLEARANCE . . . 10½ ft., traveling position.

WEIGHT . . . Approximately 3750 lbs.

FACTORY GUARANTEE ON WORKMANSHIP AND MATERIALS

COMPLETE UNIT *Now On Cross Country Tour*

WIRE OR WRITE FOR demonstration date in your area. Special demonstrations may be arranged.

the industrial monkey

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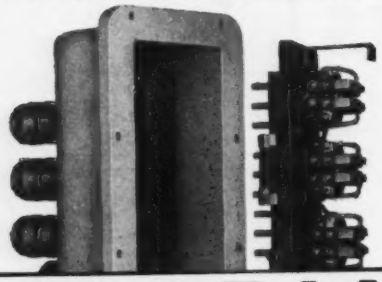
Complete Protection



Specify
UNILARM

the Unit Alarm System
. . . ready to Install

BULLETIN U-46-20 gives wiring diagrams, dimensions, prices and complete information. Write for your copy.

51

Unilarm combines in one compact unit the many features essential for complete supervision of all types of electrical and mechanical process control.

Saves valuable space, reduces engineering and installation costs to a minimum.

Plug-in panel cuts maintenance and provides continuous alarm protection.

Test switch gives instant proof of Unilarm's readiness to function under alarm conditions.

Flashing alarm signals every departure from a predetermined normal condition.

Available for panel or surface mounting.

EXPLOSION-PROOF . . . . . DUST-TIGHT
VAPORTIGHT . . . . GENERAL PURPOSE

RUSSELL & STOLL

RUSSELL & STOLL COMPANY, INC.
125 Barclay Street • New York 7, N. Y.

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

Frank R. Benedict, formerly industry engineering manager at the East Pittsburgh Works, has been appointed director of engineering and research, responsible to the manager for the technical performance of the Atomic Power Division.

Coleman, Harrison Advanced

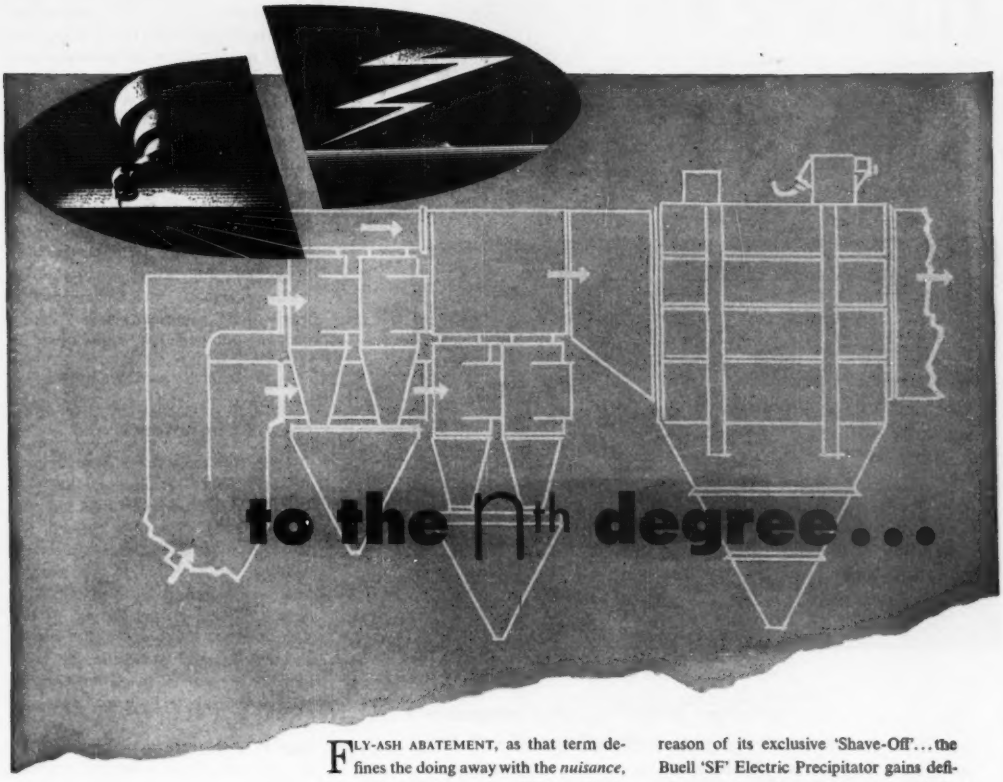
H. C. Coleman will succeed Benedict at East Pittsburgh. Coleman's former post as manager of the marine and aviation section, industry engineering departments, will be taken over by S. A. Haverstick. A. M. Harrison has been named manager of the dc engineering department of the Transportation and Generator Division at East Pittsburgh. He succeeds Clarence Lynn, also transferred to the Atomic Power Division.

Slack joined Westinghouse at Bloomfield, N. J., as a physicist in 1927. He was made research director for the Lamp Division in 1946. It was at this laboratory that the first quantity production of pure uranium for the atomic bomb project was achieved in 1942 and 1943. Slack first became nationally known for the development of an electronic tube that makes possible millionth-of-a-second X-ray pictures.

Frank R. Benedict

Benedict went to Westinghouse in 1927 as a laboratory engineer in the company's high voltage laboratory at Trafford, Pa. There he helped develop the high cathode ray oscillograph for measuring lightning currents and voltages in a hundredth of one millionth of a second. Later he took charge of the Trafford Laboratories and the high power laboratory at East Pittsburgh, was made liaison engineer on the chief engineer's staff, and became manager of engineering and service in the New England area. In 1944 he returned to East Pittsburgh as manager of the product performance analysis section of Westinghouse and in 1945 was appointed manager of industry engineering.

Coleman has been with Westinghouse since 1916. During World War I he was responsible for much of the coordination work and special engineering connected with the electrification of submarines. He has been awarded the Westinghouse Order of Merit and the Navy's Certificate of Commendation. Haverstick joined the company in 1937 and has been en-



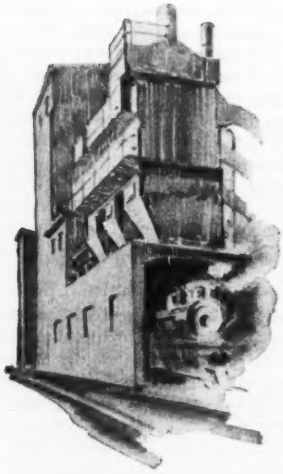
FLY-ASH ABATEMENT, as that term defines the doing away with the *nuisance*, is a call to positive action. What action is most positive, what combination of collectors most trustworthy, stands well proved among engineers—and in the court of public opinion.

Management's purpose to take most positive action is served to the n^{th} degree by a Buell 'SF' Electric Precipitator, in tandem with matching-capacity Buell van Tongeren Cyclones.

To the equipment phase of planning, Buell today offers designs based on world experience in both Precipitator and Cyclone dust collection. The Buell van Tongeren Cyclone excels in practical effectiveness by reason of its exclusive 'Shave-Off'... the Buell 'SF' Electric Precipitator gains definite operating advantage through such design features as StediFlow dust-fall.

To the engineering of such an installation, Buell brings the broadest consulting experience in high-efficiency dust collection—and a notable forth-rightness in predicating operating guarantees on attainable fractional efficiencies.

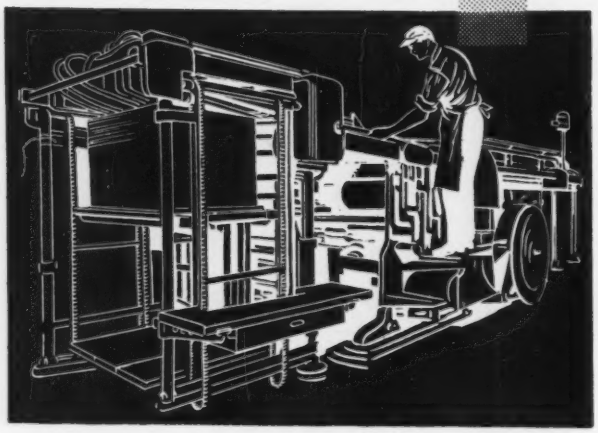
Buell engineers will welcome the opportunity to confer on basic problems or on the details of equipment. Literature for preliminary study on the collection of nuisance dust on request. Write Buell Engineering Company, 70 Pine Street, Suite 5050, New York 5. N. Y.



buell

Engineered Efficiency in **Dust Collection**

KNOW-HOW PLUS



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gaged in marine activity in the industry engineering department since then. During World War II he helped develop diesel-electric propulsion equipment for the Navy and Coast Guard.

In his new position Harrison will be responsible for the engineering design and development of all medium- and large-sized dc generators and motors for the company. He has been manager of the dc machine section of the dc engineering department. With Westinghouse since 1926, he has been active in improving manufacturing methods and has worked on development of dc commutators and in improving methods of ventilating dc rotating machines.

•

New Assignments

John F. Costigan has been named assistant works manager of the Norwood (Ohio) Works of Allis-Chalmers Manufacturing Co. He joined the company in 1918 as a machinist and has been an assistant to the general works manager at West Allis, Wis., since 1945. . . . **Axel Strong,** of the University of Washington Bureau of Business Research at Seattle, has been added to the staff of the Grant County PUD at Ephrata as industrial development director. He worked on the bureau's recent industrial survey of the Columbia Basin irrigation project. . . . **Robert N. Blatchford** has been appointed advertising and sales promotion manager of BullDog Electric Products Co, Detroit. He has been sales promotion manager. . . . **Edwin G. Aabye,** treasurer of Public Service Co of Indiana, now is serving as secretary as well. He succeeds **Edwin J. Booth,** who retired. . . . **Francis W. Cross** has been appointed sales engineer in the heavy machinery division of Nordberg Manufacturing Co, Milwaukee. Formerly he worked for Falk Corp, Le Roi Co, and Nagle-Hart Tractor & Equipment Co of Milwaukee.

•

Frederick C. Cheney and **William H. Borghesani** have been promoted to the rank of electrical engineer by Stone & Webster Engineering Corp, Boston. Cheney has spent most of his professional career with Stone & Webster. His work has included construction, design, development reports, and valuations in industrial and public utility fields. Borghesani did fire insurance

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

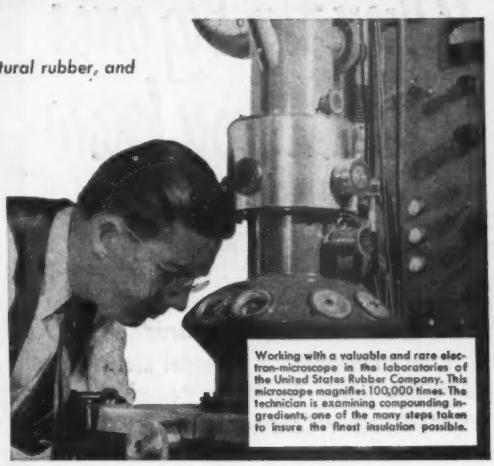
A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.



Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

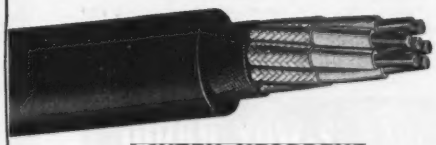
SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

NOT ONE FAILURE IN OVER 18 YEARS



LAYTEX-NEOPRENE SUPERVISORY CONTROL CABLES

There has never been a reported failure of Laytex-insulated control cable in its 18 years of manufacture. The insulation resistance of these cables actually improves in wet locations! The small diameter of Laytex makes unnecessary the enlargement of cable ducts where signal service is expanding. The Neoprene jacket provides exceptional resistance to abrasion and other abuse, and is highly resistant to the action of oil, flame, and sunlight. The cables are light in weight, easy to install.

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When the big ones use it...you know—IT'S GOOD!

NIAGARA MOHAWK

Central Division of This Great Utility Depends on General Electric Mobile Radio For Year 'Round, All-Weather Communication!

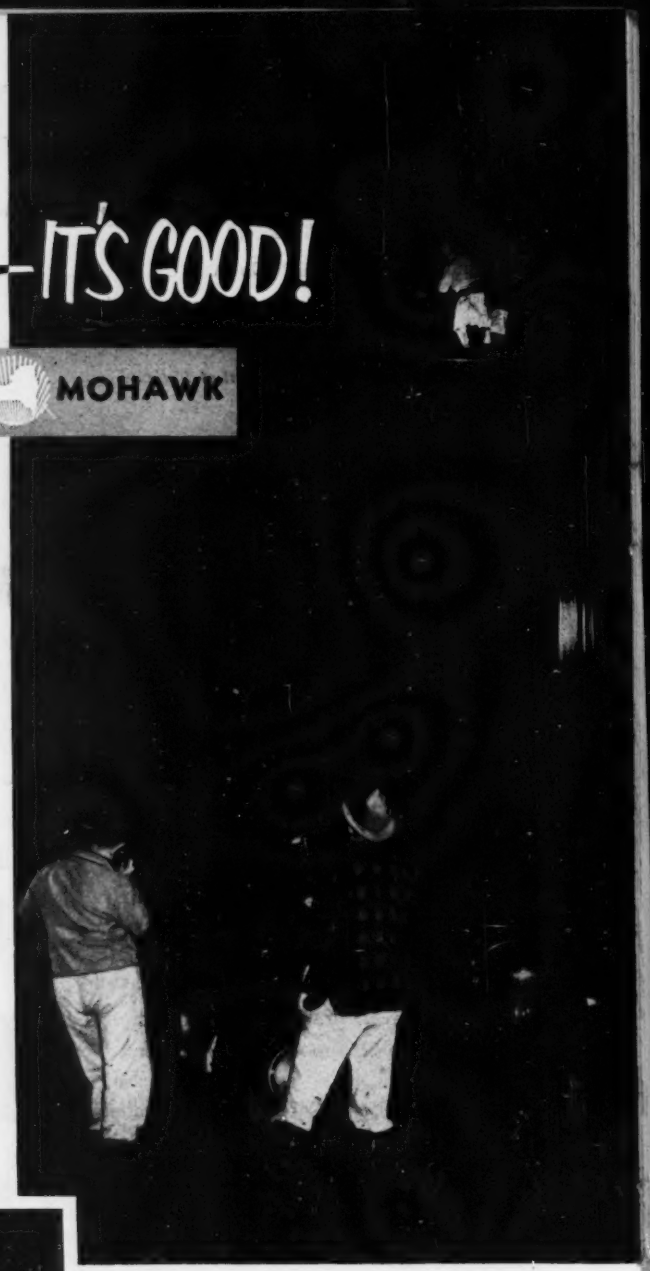
WHEN you sell electricity and gas in a 36-county area with a population of 3,000,000, service is a constant, all-season problem that demands expert attention in all its phases—*especially communications.*

Niagara-Mohawk in upstate New York is a case in point. Throughout its key central division, with headquarters at Syracuse, G-E 2-way radio ties together substations, service vehicles, supervisors' cars and supply points in a tight, efficient radio net that functions in any weather, over rough or smooth terrain.

To get more jobs done per day, to cut overtime and waste mileage, to give better service faster—many utilities find it pays to use a G-E communication system.

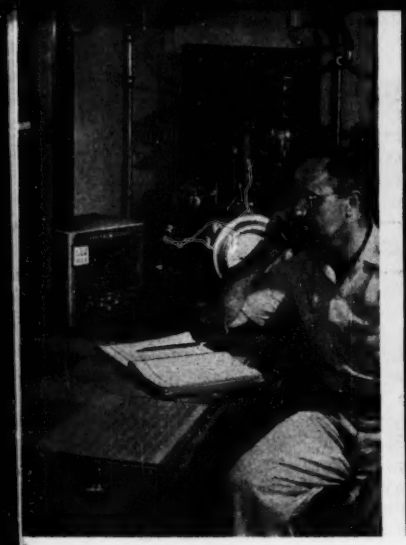
CIVIL DEFENSE—Can you tie in with your community radio net quickly, economically; in an emergency? G-E's radio communication representative will show you how. Call the Electronics office nearest you or write: *General Electric Co., Electronics Park, Syracuse, N. Y.*

2-WAY RADIO

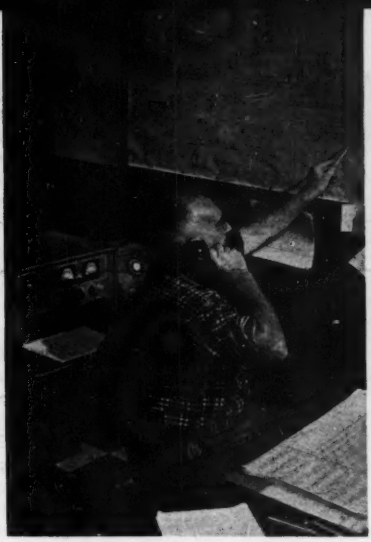


Change-over After Midnight. Planned interruption calls for careful timing, no delays. G-E mobile radio in superintendent's car provides instant contact with headquarters and other work crews, simplifies control of critical operation.

Weather Makes No Difference to this mobile radio system, because G-E's FM beam rides above static, cuts through interference. Superintendent Jack O'Brien (left) reports that switchover has been completed, power can now be turned on.

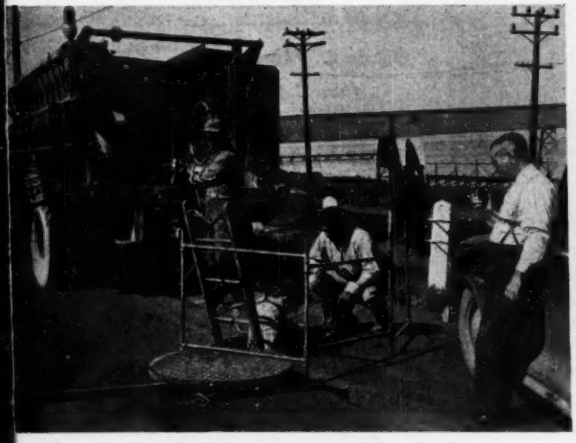


Reporting Gas Pressures and Volumes at a metering station, chief station operator uses radiotelephone to call main office. Because shifting winter temperatures mean fast-changing demand for gas, constant exchange of pressure data is important.



At Hydro Station district operator directs line crews by radio in his 5,000 square mile area. Operating diagram on wall simplifies trouble-shooting, shows service lines in upstate counties. Remote control console at left is latest G-E model.

Savings In Waste Mileage Alone have paid for Niagara-Mohawk's radio system many times over. On transformer job at a farm 20 miles from Syracuse, lineman (above) radios headquarters for instructions and supplies.



"Wipes Out Time Lag", is one reason utilities give for the popularity of 2-way radio. In photo above, supervisor Bill Malay directs subway crew, talks to headquarters via hand microphone. At Niagara-Mohawk, 105 construction and maintenance vehicles are equipped with G-E mobile radio.

Fast Action In Emergencies. From control desk, dispatcher Frank Kaiser is in radio contact with 45 supervisors and service units on the road. He talks instantly with crews in motion miles away and at isolated work sites.

Let's Get Acquainted!

The G-E radio communication representative in your area has facts worth your consideration. Call him today. Meanwhile, send for free bulletin X55-752: *General Electric Company, Section 1911-29, Electronics Park, Syracuse, New York.*

You can put your confidence in—

GENERAL ELECTRIC

UTILITIES LIKE
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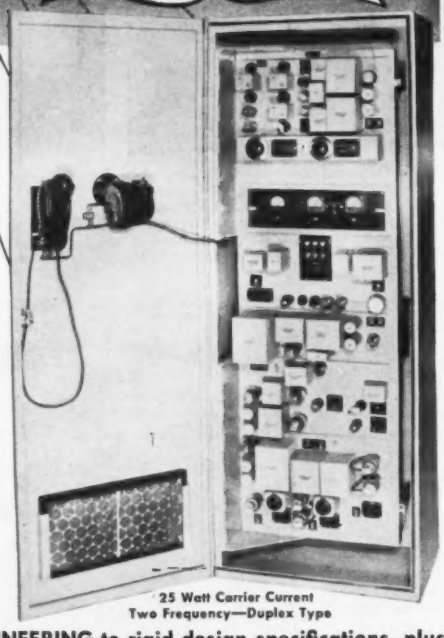
BETTER PERFORMANCE
when the going is rough and
reliable communication is
most important



APPLICATIONS:
- Supervisory Control
- Telemetering
- Communication
- Protective Relaying

25 Watt Carrier Current
Two Frequency—Duplex Type

THOUGHTFUL ENGINEERING to rigid design specifications, plus careful workmanship, provide carrier current equipment that gets through under adverse operating conditions

OPERATING DEPARTMENTS like its:
- Superior frequency characteristics for easy understandability of orders
- Ease of use
- Dependability

PLANNING ENGINEERS like its ADAPTABILITY:
- 25 watt or 10 watt
- Single frequency or multiple frequency operation
- Crystal controlled or variable frequency tuning
- Push-to-talk or voice operated relay

MAINTENANCE MEN like its:
- Trouble free operation
- Swinging panel construction
- Plug-in relays
- Sensible test panel
- High quality components

CHECK on Control Corporation carrier current and see why utility engineers are ordering it in preference to other makes. Write us for list of users and additional design information.

CONTROL CORPORATION
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• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current •

engineering and rating analyses for three years before joining Stone & Webster in 1942. He became an engineer in the electrical division in 1947 and has been active in utility steam-plant projects, including major design and installation work for Pacific Gas & Electric Co.

Robert C. Ross has retired from active service with Joseph T. Ryerson & Son, Inc, Chicago, after 47 years with the company. After starting as a telegraph operator in 1903 he served as head of the traffic and service departments, assistant to the president, and since 1931 vice president in charge of operations and director. He has been executive in charge of plant operations, with particular emphasis on modernization and expansion. During World War I he was chairman of the Industry Co-operative Committee with Railways of the Middle West.

OBITUARY

Oscar C. Merrill

Dr. Oscar C. Merrill, 76, first executive secretary of the Federal Power Commission and author of the Federal Water Power Act of 1920, died Jan 15 in Bethesda, Md., after an illness of nearly three years.

A civil engineer, Merrill served as chief engineer of the United States Forest Service and drafted the water power act while in that post. He was credited with developing a policy that brought much of the country's water power resources under federal control.

When FPC was set up in 1920 he became executive secretary. He remained on the commission until 1929.

After leaving FPC Merrill became chairman of the American Committee of the World Power Conference and was director of the third conference, held in Washington in 1936. In 1942 he was an engineer and economist for the United States-Mexico Oil Commission, which studied United States claims against the Mexican government. Later he served as a principal engineer with the Army Engineering Board. He retired in 1943.

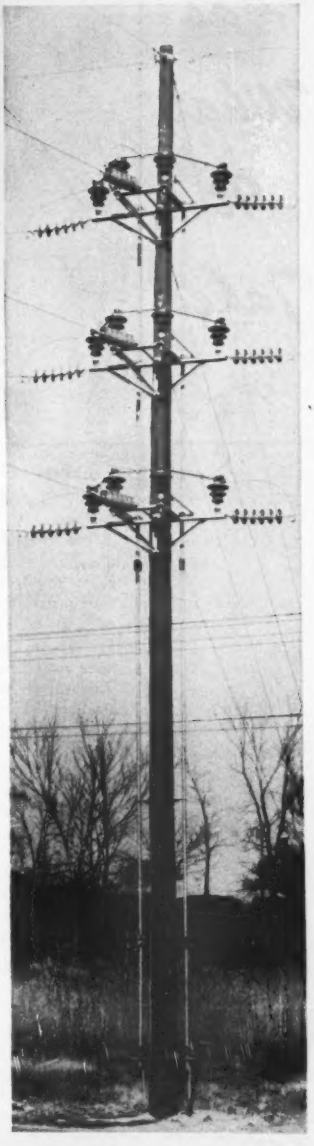
Merrill was the author of "Electric Power Development in the United States," a three-volume work published by the Government Printing Office in 1916, and edited the "Transactions" of the third World Power Conference

MATTHEWS GOABS Conserve

. . . Material

. . . Manpower

. . . and Right of Way



RECENTLY this Matthews GOABS was installed by the Iowa Power and Light Company on their 46 kv loop around the city of Des Moines, Iowa. Its purpose is to allow feed to be maintained to a new substation about a half mile away.

Because of a proposed widening of the street, a right-of-way problem had to be solved. There was no room for an H frame structure. Since it is mounted on one pole, the Matthews GOABS proved to be the perfect solution. This installation was completed in approximately ten hours by a five-man crew.

In addition to the savings gained through the conservation of man hours and right-of-way required for at least four poles, two switch frames and six strings of suspension insulators were also eliminated.

The company has reported that all operations to date have been very satisfactory.

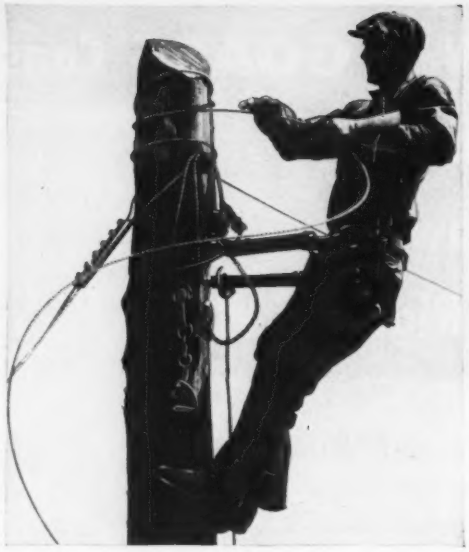
WRITE FOR BULLETIN 601 FOR COMPLETE INFORMATION

W. N. MATTHEWS CORPORATION

3844 Delor Street, St. Louis, Mo.

ENGINEERS and MANUFACTURERS SINCE 1899

Has What It Takes



For Guys, Messenger and Overhead Ground Wire

EXPERT linemen know, when they use *Crapo* Galvanized Steel Strand, that it will meet every requirement the job demands. For *Crapo* Galvanized Strand "has what it takes" — *strength, ruggedness, workability, long-life.*

These essential characteristics, combined with ever important ECONOMY, make *Crapo* Galvanized Strand first choice for guys, messenger and overhead ground wire. The superior tensile strength of the steel is utilized to fullest advantage in each size and grade. The heavy, ductile, tightly-adherent galvanized coating — applied by the famous *Crapo* Process — provides dependable protection for the steel, prolongs the expectant life of the strand.

The all 'round reliability and overall economy of *Crapo* Galvanized Strand are matters of record with leading strand users. Such records contain ample and significant proof of the long life and low annual cost of this strand in service.

Available for Prompt Delivery

There is a size and grade of *Crapo* Galvanized Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write for further information!

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo GALVANIZED STEEL STRAND

and the second International Congress on Large Dams.

•

Wynne Meredith, 86, engineer and partner in the San Francisco branch of Sanderson & Porter, New York engineers and constructors, died in Oakland recently. He supervised installation of Pacific Electric Railway Co equipment in Los Angeles and electric power systems in Vancouver and Victoria, B. C. He went to San Francisco in 1894 to handle electrical installations at the Mid-Winter Exposition. In 1906 Sanderson & Porter retained him as a consultant on western hydroelectric projects, and two years later he became a member of the firm. Meredith aided in the development of rheostats, high tension electric switches, the battery boosting system, and other electrical apparatus. He was a fellow of the American Institute of Electrical Engineers.

Eugene L. White, 59, president and director of Allied Power & Light Co, Pittsford, Vt., and of various Geneseo, N. Y., gas utilities, died Jan. 11 in Ocean City, N. J. White was a former vice president and general manager of New Jersey Power & Light Co, Dover, and of South Jersey Power & Light Co and was a director of Atlantic City Electric Co, which absorbed South Jersey.

Roy E. Blossom, 68, retired secretary of the Indiana Electric Association, died Dec. 30 at Indianapolis. Blossom served the electric association as secretary from 1939 until his retirement in 1944. He had been merchandising manager of Indianapolis Power & Light Co from 1932 to 1937 and later became manager of Station WFBM.

Frank T. Wheeler, 76, a founder of Trumbull Electric Co, died recently in Plainville, Conn. With Henry Trumbull and former Gov John H. Trumbull Wheeler formed the company in 1899. He was vice president when he retired in 1945.

Edward Bennett, 74, Madison, Wis., consulting engineer and former chairman of the electrical engineering department at the University of Wisconsin, died Jan. 11. His early career was spent with Westinghouse Electric Corp, where he did research on lightning arresters and helped develop the Nernst lamp for George Westinghouse. Later he was chief engineer for Nernst

2 "musts" FOR THE BEST in BREAKERS

1—BE SURE THEY'RE AIR BLAST

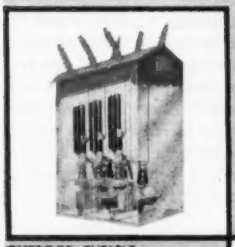
2—BE SURE THEY'RE BROWN BOVERI

Brown Boveri Air Blast Breakers are the best in power circuit breakers. They are HIGH SPEED breakers, 3 cycles on any voltage available. They furnish POSITIVE INTERRUPTION UNDER ALL CONDITIONS including heavy capacity switching. They provide RAPID RECLOSING — 3-phase all voltages, single-phase 69 kV up.

What's more, they provide a greater SAFETY FACTOR with no secondary damage even if highly overstressed. No oil handling, no fire hazards. They require a MINIMUM of MAINTENANCE. And they are world-famous for DEPENDABLE PERFORMANCE.

Brown Boveri Air Blast Breakers are available as Outdoor Breakers, Outdoor Cubicles and Indoor Breakers. Below is a list of the standard outdoor types.

It will pay you to investigate Brown Boveri's complete line of Air Blast Breakers. *Write for full details and specifications.* Mail the coupon below, TODAY!

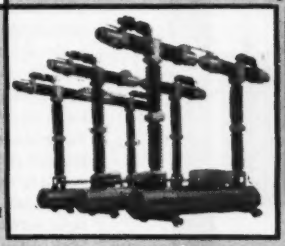


OUTDOOR CUBICLE

Standard Ratings OUTDOOR CUBICLES — 14.4 TO 46 kV

TYPE	kV CLASS	AMPS	INTERRUPTING CAPACITY*
14.4 n 500	14.4	1500	500,000
14.4 n 1000	14.4	1500**	1,000,000
23 m 500	23	1000	1,000,000
23 n 1000	23	1500**	1,000,000
34.5 m 500	34.5	1000	500,000
46 m 1000	46	1000	1,000,000

All breakers for 3 CYCLES speed. All breakers suitable for *rapid reclosing.*



STANDARD OUTDOOR BREAKER

Standard Ratings OUTDOOR BREAKERS — 69 TO 230 kV

TYPE	kV CLASS	AMPS	INTERRUPTING CAPACITY*
69 k 1200	69	800 and 1000	1,200,000
115 k 2000	115	800 and 1000	2,000,000
115 m 3500	115	1200	3,000,000
138 k 2500	138	800 and 1000	2,500,000
138 m 3500	138	1200	3,500,000
161 m 3500	161	1200	3,500,000
161 m 5000	161	1200	5,000,000
230 k 3500	230	800 and 1000	3,500,000
230 m 6000	230	1200	5,000,000

All breakers with ASA standard speeds, as for 3 CYCLES speed if required. All breakers suitable for *rapid reclosing, single phase* and *three-phase.*

* Symmetrical or A.C. component, on fully asymmetric current, the breakers will safely handle 130% of these values.

** Higher current and interrupting ratings are available.

NOW AVAILABLE!

Complete specifications in detail and dimensional diagrams can now be supplied for all types listed. Please indicate on the coupon at the right, type numbers in which you are interested.

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19 Rector St., New York 6, N. Y.

BROWN BOVERI — WORLD ENGINEERING & MANUFACTURING LEADERSHIP FOR OVER 50 YEARS IN MECHANICAL & ELECTRICAL POWER EQUIPMENT.

SWITCHGEAR • REGULATORS • RELAYS • MOTORS & TRANSFORMERS • TURBINES

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BROWN BOVERI CORP., 19 Rector Street, N. Y. 6
Please send me specifications and details on your
☐ indoor ☐ outdoor air blast breakers for
_____kV _____Amps. _____kVA.

Name_____Title_____

Company_____

Address_____

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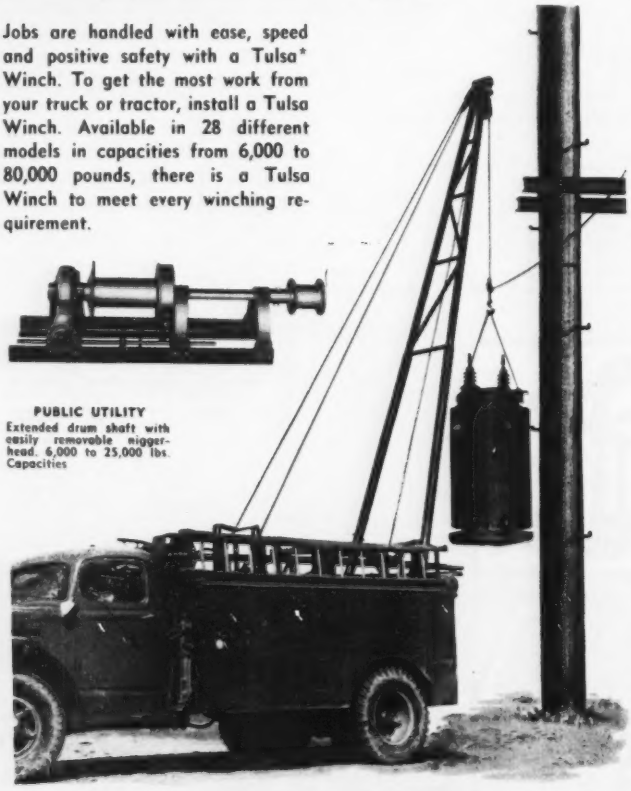
PULL *and* POWER

Tulsa Winch models for all trucks from ½-ton up.

Tulsa Winches for all crawler tractors complete with transmission, line roller assembly and mounting brackets ready for installation.

Jobs are handled with ease, speed and positive safety with a Tulsa* Winch. To get the most work from your truck or tractor, install a Tulsa Winch. Available in 28 different models in capacities from 6,000 to 80,000 pounds, there is a Tulsa Winch to meet every winching requirement.

PUBLIC UTILITY
Extended drum shaft with easily removable nigger-head. 6,000 to 25,000 lbs. Capacities



*Reg. U. S. Pat. Off.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS INC.

815-49 E. First Street

Lamp Co and a partner in Beebe & Bennett, Pittsburgh consulting engineers and contractors. He also did station design and research on long distance transmission of power for Telluride Power Co. He joined the Wisconsin faculty in 1913.

Harold H. Millar, 63, commercial engineer of Electrical Testing Laboratories, Inc, New York City, died Jan. 12. He had been with the laboratories since 1913. Among positions he had held were those of lamp inspector at Oakland, Calif., West Lynn, Mass., and New York and engineer in charge of appliance testing.

Stanley Challoner Fawcus, 65, cable system designer for British Columbia Electric Railway Co, died recently at Vancouver, B. C. Fawcus, who served the utility for 39 years, had officially retired at the end of 1950 but agreed to continue until March because of the heavy pressure of work. He was in charge of designing and installing all of the underground and submarine power cables of the company.

Robert S. Mercur, 50, district manager of the Wilkes-Barre division of Pennsylvania Power & Light Co, died Jan. 4 at Wilkes-Barre. He had been with Pennsylvania Power & Light since 1924 and had served as assistant manager and manager of the Williamsport district before being transferred to Wilkes-Barre in 1947.

Clarence Orville Bunnell, 59, retired district manager for Pacific Power & Light Co at Hood River, Ore., died recently at Hood River. His utility career began with Pacific Power & Light in 1916. Before going to Hood River as district manager in 1943, Bunnell did power plant and transmission line work, right of way and claims work, and supervised the company's farm service program. He retired in May, 1950.

Lucius A. Tucker, 68, retired district manager of Louisiana Power & Light Co, died recently at Donaldsonville, La. Tucker became manager of the municipal power plant at Donaldsonville in 1921 and remained in that position when it was taken over by Louisiana Power & Light. He retired two years ago.

John C. Strohpagel, 70, former head of the Sturgis (Mich.) municipal power plant, died recently in Sturgis.

In peace and in war, since the early beginnings of the electrical industry, this organization has provided economically sound services to the managements of electric utilities and industrial companies.

★ DESIGN AND CONSULTING SERVICE

Our services include the engineering design, operation and management of utility and industrial plants, electrical transmission systems, substations and distribution systems, flood control and water supply systems, office and service buildings, warehouses, and other facilities. Our engineers make economic investigations and reports, prepare estimates, execute designs, coordinate construction, make forecasts and load factor studies, conduct power system studies and provide consulting service.

★ PURCHASING AND EXPEDITING

In times of tight supply and priorities, the services of our purchasing engineers are especially valuable because of their broad experience as agents for clients in the purchase of materials and supplies required for construction projects, and in furnishing the necessary close connection between the design engineer and the source of manufacture. The division's activities cover procurement and evaluation of bids, negotiation of contract detail, and the expediting of factory deliveries so that all will fit into the design and construction schedule required.

★ VALUATION SERVICES

These services include the review of and consultation on the maintenance of fixed capital and continuing property records, review and interpretation of commission classifications and rulings relating to fixed capital accounting, review and interpretation of depreciation practices of commissions and the Bureau of Internal Revenue, review of and consultation on current depreciation policies, consultation on the preparation of income tax returns, and services in the settlement of income tax cases with reference to depreciation rates and the depreciable property base.

★ RATE AND RESEARCH SERVICES

This service provides comparative cost studies and statistics, cost of service allocations, analysis of market trends in relation to operating costs, customer analysis and rate design, advice and assistance in preparing and presenting rate cases, review and interpretation of court and commission decisions and research and counsel on economic and regulatory problems.

★ CORPORATE SERVICES

Business and management engineering counsel. Pioneer's consultants provide experienced, practical advice on matters of company organization, general planning, personnel, and other management policies.

Corporate finance. Pioneer's financial men are equipped to make analyses of capitalization, determine type of securities, prepare documents for regulatory bodies, prepare or assist in the preparation of registration statements and prospectuses, advertise for bids, hold bidders' meetings, assist in negotiations for sale of securities or award of contracts, distribute stocks and stock rights, and deliver securities.

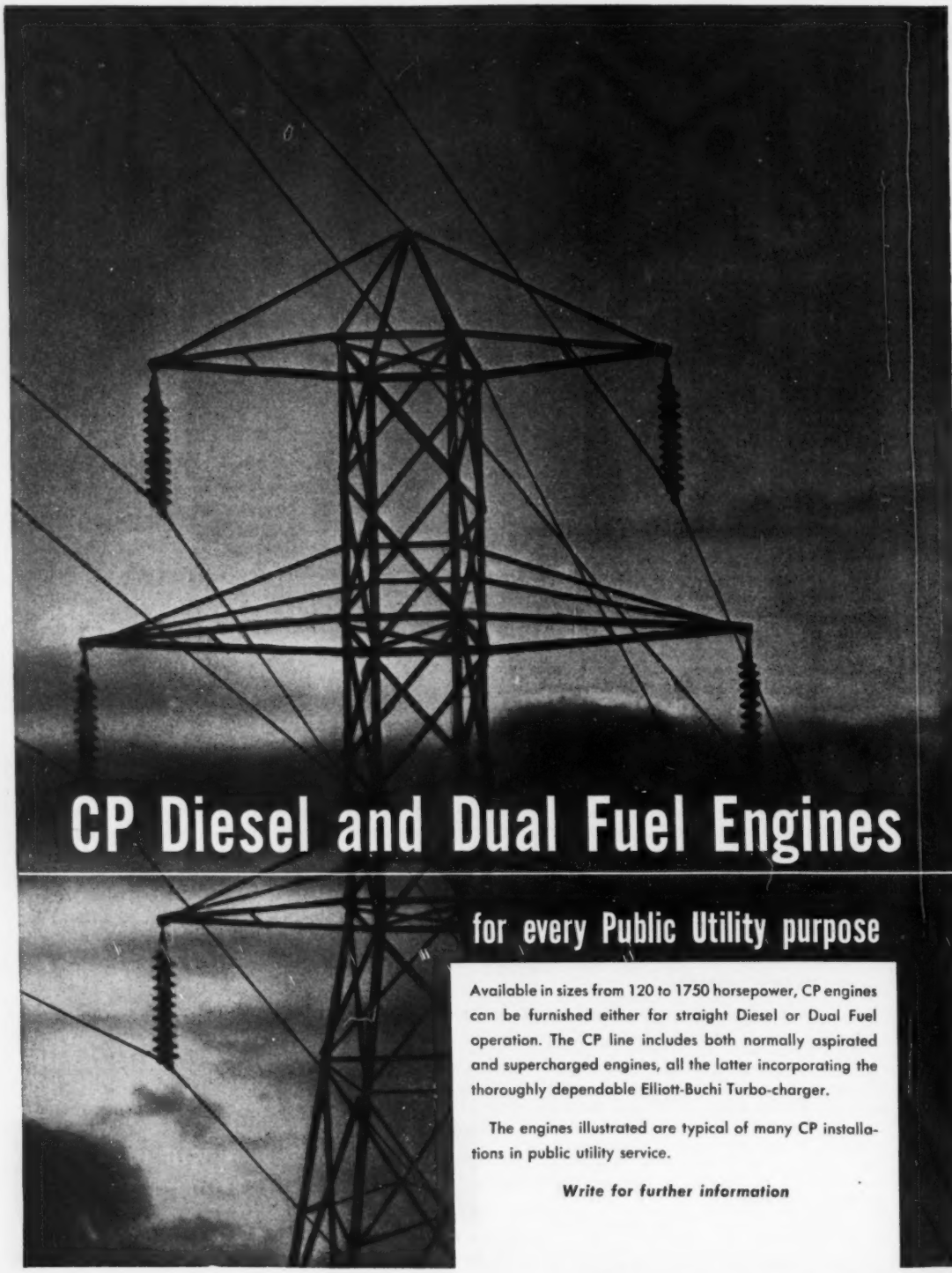
These services also include stock transfer and dividend distribution, accounting and tax counsel and assistance with property records, depreciation, insurance and pensions.

"Pioneering New Horizons", a new booklet

Tells the story of half a century of Engineering Initiative from the design of the world's first electric central station to the first installation of a gas turbine in a public utility system. Send for your copy.

Pioneer Service & Engineering Co.
231 South LaSalle Street • Chicago 4, Illinois

AN INDEPENDENT ORGANIZATION



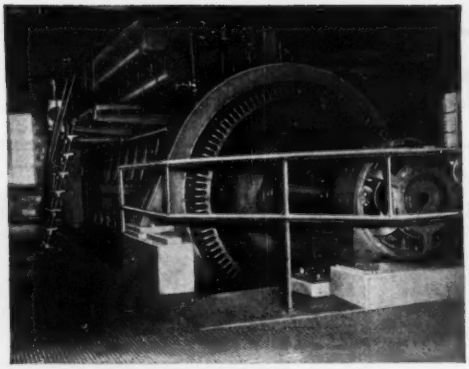
CP Diesel and Dual Fuel Engines

for every Public Utility purpose

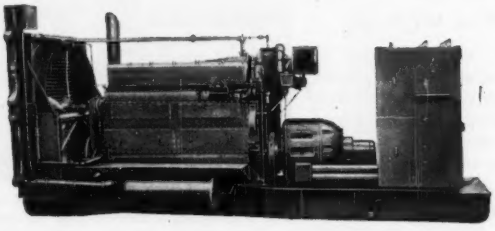
Available in sizes from 120 to 1750 horsepower, CP engines can be furnished either for straight Diesel or Dual Fuel operation. The CP line includes both normally aspirated and supercharged engines, all the latter incorporating the thoroughly dependable Elliott-Buchi Turbo-charger.

The engines illustrated are typical of many CP installations in public utility service.

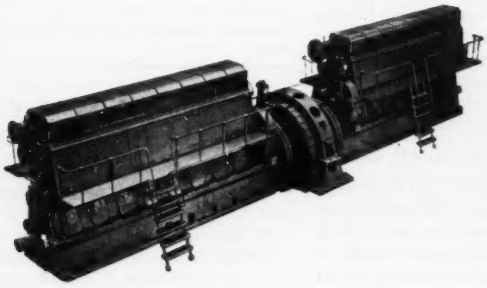
Write for further information



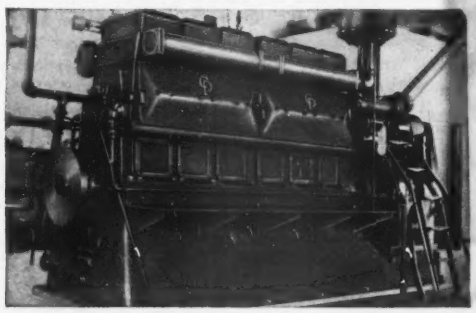
1650-hp Dual Fuel Generator unit in public utility plant – 327 rpm, 1150 kw.



500-kw CP Portable Generator unit for public utility emergency service.



Twin Engine Generator unit rated 2250 hp, 1500 kw.



A 175-kw Diesel Electric unit in a prominent utility plant, with more than 14,000 hours service to date.

CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

MANUFACTURERS and MARKETS

Westinghouse Slates Expansion to Up Generator Production 65%

Westinghouse Electric Corp's capacity to produce large electric generators will be boosted about 65% by an expansion program at its East Pittsburgh Works announced last week.

Two new buildings will provide more than 300,000 additional sq ft for generator production. This will make possible construction of 3,600-rpm generators of more than 150,000 kw capacity.

To Add Nearly 3 Million Kw

Aim of the expansion program, Westinghouse said, is to enable the firm to produce its share of the units needed to give the nation 200 million kw by 1970. The program will up the company's productive capacity for high-speed, high-capacity power generators from some 3 million kw to almost 6 million kw a year by the middle 1950's. The company turns out about 35-45% of total industry production.

Westinghouse now is doing design work on generators of more than 150,000 kw capacity. The railroads are studying the problem of furnishing special cars to handle their shipping. Use of two 200-ton cranes will make it possible to ship units completely assembled to customers which themselves have the crane capacity to handle such a load.

2 New Buildings Planned

The new buildings to be erected are (1) Section D Annex building—large generator production aisle—and (2) a shipping and warehouse building. The annex is to be in production by 1952 and to be fully completed by 1953. A November, 1951, completion date has been set for the warehouse. The construction contract has been awarded to Stone & Webster Engineering Corp.

Three old buildings, one of them built by George Westinghouse in 1893 for the production of water and gas meters, are being demolished to make room for the new structures. A two-month-long rearrangement program involving 250,000 sq ft of floor space has already made room for the departments formerly housed there. Westinghouse also is considering building a four-level parking garage.

Annex to House Five Cranes

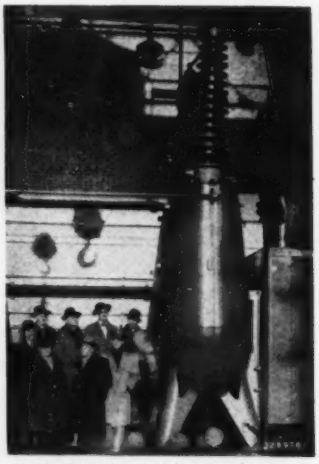
The 1,000-ft long, one-story D Annex will be adjacent to the present D Aisle but with the intervening wall removed. It will house two high-level 200-ton cranes 66 ft above the floor that can team up to carry as much as 350 tons. Three 50-ton cranes will be 45 ft above the floor. Steel supporting columns will extend 42 feet underground to rest on bedrock and will reach up to a roof 93 ft above ground.

The production aisle building will have an exterior of brick, steel sash windows, and composition siding. High-bay lighting of 1,000-w mercury vapor lights interspersed with 1,500-w incandescents will provide a lighting level of 45 ft-c on the floor. Between D Aisle and D Annex will be an 11-ft-wide traffic aisle and above it a mezzanine floor for equipment and storage.

Warehouse to Provide 4½ Acres

The steel, concrete, and brick shipping and warehouse building will provide 4½ acres of floor space. Five electrically operated tramrail cranes on the first floor and two on the second floor will move materials. Reversible rubber conveyor belts to carry smaller materials and elevators at each end of the building will reach all four floors. Fluorescent lighting in the fireproof warehouse will provide 50 ft-c in the offices on the third and fourth floors and 35 ft-c in the 18-ft-high warehouse area.

When the plant is completed and fully operating, some 1,000 to 1,500 additional employees will be needed, not all of them directly on generator production.



OIL SAVINGS of 50% are effected by new Westinghouse Electric Corp 7.5-million-kva, 320-kv, 3-cycle circuit breaker through form-fitting "watch-case" design. On hand for tests in company's High Power Laboratory are, l to r, front row, W. M. Leeds, Westinghouse; A. Crumb, L. A. Wilson, E. J. Harrington, Bonneville Power Administration; back row, R. O. Bonine, Westinghouse, V. G. Muzsnay, R. P. Walters, and H. B. Schroeder, Bonneville Power Administration

Alcoa Monopoly Suit Ends after 14 Years in Courts

The Department of Justice's 14-year-old anti-trust suit against Aluminum Co of America came to an end in New York last week when the principal Alcoa stockholders who also own shares in Aluminium, Ltd, of Canada agreed to dispose of those holdings over a 10-year period and Federal Judge John Knox accepted their plan.

During the disposal period three court-appointed trustees will exercise the voting power of the Aluminium stock, approximately 48% of that outstanding. They are Donald K. David, dean of the Harvard School of Business Administration; John L. Sullivan, Washington attorney and former secretary of the Navy, and the Chemical National Bank & Trust Co of New York.

"The Most Significant Development Since Edison's Lamp"

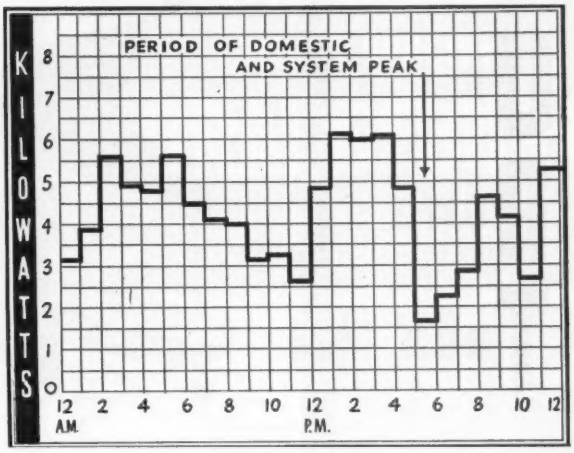
"A statement by a utility executive about 'Glassheat'"

ELECTRIC HEATING with *Glassheat* is CONTROLLABLE — thus PROFITABLE

1. The chart shown is taken from an actual home with "Glassheat" installation in a 6000 Degree Day area on the day of the Utility's Residential peak, which occurred between 5 P.M. and 6 P.M.* on December 24th, Christmas Eve.

2. At this time the demand on the heating circuit was less than 2 kw., yet the design heat loss was equivalent to over 15 kilowatts. Thus, for less than 2 kw. of significant peak demand, over 18000 kw. hours were used on this circuit for heating during the 6000 degree days. The outside temperature at 5-6 P.M. was 26° F. and falling. It was a 37 degree day.

*The 60 minute demand in the hour before control was 4.8 kw. During control it was 1.65 kw. and immediately after control was 2.25 kw. It did not reach the equivalent of demand in the hour before control until 11 P.M., or 5 hours after control was released.



The Public is becoming increasingly conscious of "Living Electrically!" Close cooperation between the Utility Companies and Continental Radiant Glass Heating Corp., can meet the rising public demand, greatly expand the market... thereby developing a source of tremendous PROFIT POTENTIAL.

To develop LOAD CHARACTERISTICS that are profitable to the Utility Organizations—at rates satisfactory to the public—all proposals for the use of "Glassheat" panels must be understood from the Utility viewpoint so that the products are intelligently sold and properly installed.

CONTINENTAL RADIANT GLASS HEATING CORP.—America's Leading Manufacturer of Electric Space-Heating Equipment—works continuously with Utility Companies. Continental can and DOES grasp their particular problems—always ready and able to design "Glassheat" installations with Utility Profits and Consumer Benefits in mind.

Continental's policy of "Controlled Selling of Planned Electric Heating" means BETTER LOAD CHARACTERISTICS—GREATER CUSTOMER SATISFACTION.

CONTINENTAL RADIANT GLASS HEATING CORP.

1 East 35th Street

New York City, N. Y.

U-D-T Fixture Hangers'
3-way locking speeds installation!

Helpful as another pair of arms, these solid-gripping GUTH U-D-T Hangers allow one man to hang fixtures quickly and securely:

1 Ceiling bridge is attached to ceiling or outlet box.

2 Stems are locked into fixtures and canopy slipped on stems.

3 Stems are hooked onto ceiling bridge and canopy fastened to bridge. Fixtures are leveled quickly with handy set screws atop their channels.

GUTH

NEW LOW-PRICED U-D-T Hangers are available for both single and double stem attachments. See the U-D-T at your GUTH distributor today —or write for Bulletin 873-H.

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

The Alcoa case has been in the courts ever since April, 1937. It produced the longest trial in the history of English-speaking jurisprudence.

Last June Judge Knox refused the government's petition to divest Alcoa of plants and properties and ruled that effective competition existed in the postwar aluminum industry. To insure continuance of complete independence of Aluminium, Ltd, as a competitive factor in the American market, he ordered Alcoa stockholders who owned stock in Aluminium to dispose of their holdings in one corporation and to submit a plan for disposal by Jan. 15, 1951. There was no appeal from this judgment.

In last year's decision the judge also reserved a five-year period to determine whether competition that entered the aluminum ingot market as a result of the war is effective. This trial period is still in effect.

A total of 1,292,175 shares of the 3,722,050 common shares of Aluminium, Ltd, will be disposed of over the 10-year period. For 488,195 additional common shares, owned by Doris Duke and the Mellon children's trusts, the trustees will have voting rights, though disposal of these shares was not ordered. Edward K. Davis, former president of Aluminium, elected to dispose of all his 34,500 shares of Alcoa.

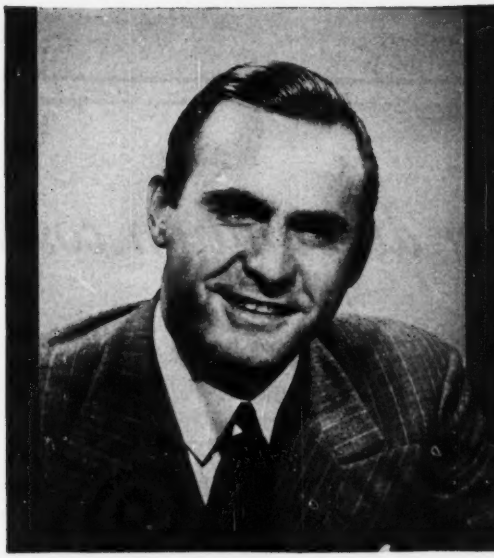
MANUFACTURING BRIEFS

Ward Leonard Electric Co, Mount Vernon, N. Y., has established a new industrial chrome division for development and manufacture of chrome plating units, solutions and processes for industrial hard chrome plating of machine tool accessories, and component parts. William G. Dawson is manager of the new division.

Benjamin Electric Manufacturing Co, Des Plaines, Ill., maker of industrial, incandescent, and fluorescent lighting equipment, is celebrating its fiftieth anniversary in 1951.

Metal Prices
Jan. 22, 1951

COPPER, Conn. V., lb	$ .24½
LEAD, N. Y., lb	.17
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits qual, N. Y., lb	1.75½
ALUMINUM, ingot, base price	.19
NICKEL, base price	.50½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	46.50



HERE ARE Down-to-Earth Reasons WHY I SPECIFY ORANGEBURG

—Says the Utility Engineer

In plain language this is what the Utility Engineer means. Orangeburg Conduit provides a *permanent* cable raceway *underground*. It will not corrode, lasts indefinitely. Its impermeable wall and tight joints prevent corrosive ground waters from entering. Orangeburg lays faster at lower cost. Protects cable sheath from abrasion when pulled in—also from wear during cable movement due to alternate expansion and contraction with changing loads. Resists acids, alkalis, grease, oil. Orangeburg Conduit is tough, durable and resilient—will not crack or break when properly handled.

PROTECTION . . . POWER . . . PRODUCTION

They are big words under today's conditions because permanently protected cables keep the *power* flowing and the *production* up to essential volume. The Utility Engineer appreciates the close connection between cable *health* and community *wealth*. Orangeburg is a magic name . . . and has been for 58 years . . . with public utilities and municipalities . . . because the lasting protection that Orangeburg Conduit gives electrical services underground assures uninterrupted power for all users of electricity.

Orangeburg saves money, too, by faster and easier handling, tooling and laying . . . and by supplying a complete line of delay-preventing standard fittings for conduit. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG STANDARD

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ORANGEBURG NOCRETE

. . . installed without concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.

ORANGEBURG FIBRE CONDUIT

STANDARD Installed with Concrete

NOCRETE Installed without Concrete

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DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

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Lower distribution costs

depend on

PLANNING

not patching!

YOU CAN BE **SURE**.. IF IT'S

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PATCHING is a temporary and often costly expedient . . . particularly in the case of a distribution system. Today's load forecasts strongly suggest that only long-range system *planning* will enable you to serve future loads economically.

It is important to decide *now* on the objectives to be attained . . . and work toward these objectives as you expand or make replacements to your present system. Current trends offer helpful direction . . . and they indicate that the pattern of the future will be . . .

A simplified system! One in which complex interconnections and costly problems of relaying are eliminated . . . one requiring a minimum of equipment . . . less maintenance. On the subtransmission level, *simple loop or radial patterns* seem to best fit this description.

There are opportunities to combine simplicity with quality service and operating economy in other parts of the system, too. The increased use of spot networks, secondary networks and banked secondaries attests to this. It also indicates wider use of a second cost-cutting tool . . .

Standardized, factory-assembled substations! The inherent flexibility of these units permits you to economically employ any of the systems mentioned. Less-costly bus regulation, minimum use of high-voltage buses, and shorter distribution feeders are several important reasons.

Let these facts set the course for your system planning . . . and let Westinghouse help. Our engineers and complete system planning facilities are at your service. Call your nearest Westinghouse Office or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-97148

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"Electric Utility Power Distribution Systems", B-3905
"Co-ordinated Substations", B-4061
"The A-C Secondary Network System", B-4002-A

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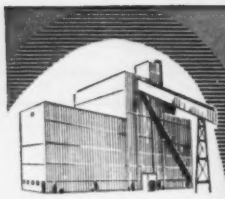

POWER DIVISION

7500 Kilowatt Electric Plant of Iowa Public Service Company at Storm Lake, completed spring of 1950.

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Pritchard Built

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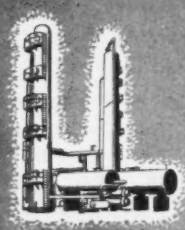
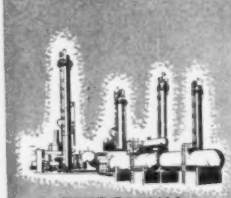
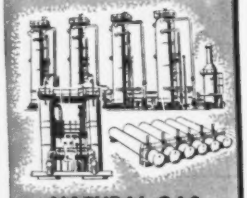
for Maximum Efficiency at Lowest Cost



CHEMICAL DIVISION



PETROLEUM DIVISION



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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona—Bureau Reclamation, Dpt. Interior, Phoenix, Ariz., constr. Maricopa sub-station Davis Dam Proj., Spec. 300C-9 L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Colorado—Bureau Reclamation Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, installing generator (second unit) for Flatiron Power Plant, Colorado-Big Thompson Proj., approx. 11 mi. southwest of Loveland and approx. 15 mi. east of Estes Park, Spec. DC-3279 1. N. McClellan, ch. engr.

Ind., Richmond—Bd. P. Wks., Earl Beck, supt. light plant, City Hall, municipal light plant expansion **$3,000,000**, Sargent & Lundy, 140 S. Dearborn St., Chicago, Ill., consult engrs.

Kan., Kansas City—Bd. Pub. Utilities, G. B. Little, secy., (1st Phase) 40,000 kw turbine generator, power plant extensions, ultimate capacity 120,000 kw. Three year program, **$9,000,000**. Burns & McDonnell Engineering Co., 95 and Troost Sts., Kansas City, Mo., engr.

Mich., Lansing—City, Otto E. Eckert, genl. mgr., brick, steel, concrete municipal power plant addn. to Moores Park Station, **$4,500,000**. Burns & Roe, Inc., 233 Broadway, New York 7, N. Y., consult. engrs.

Minnesota—Mille Lacs Region Co-operative Power & Light Assoc., Aitkin, 86 mi. rural distr. lines and sys. imprvs., Aitkin Co. **$325,000**.

Montana—Bureau Reclamation, Hungry Horse Gov't Camp, Columbia Falls, completion of Hungry Horse Dam, power plant, switchyard, South Fork of Flathead River about 9 mi. southeast of Columbia Falls, Hungry Horse Proj. Spec. DC 3282.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., 4 carrier-current telephone transmitter receiver sets, 6 carrier line tuning units, two 115,000 volt and 161,000 volt coupling capacitors, 6 carrier-current line traps, 3,000 lin. ft. coaxial cable, Fort Peck Proj. Spec. DS 3286, L. N. McClellan, Bldg. 1A, Denver Federal Center, Denver, Colo., ch. engr.

Nebraska—Custer Public Power Dist., Frank Haumont, pres., Broken Bow, 200.8 mi. rural distr. lines, incl. labor, materials and equip. except meters, conductor and transformers in McPherson, Logan, Thomas and Cherry Counties, Proj. Nebr. 83EFG Custer, Sect. IV. Raymond H. Reed & Co., 2305½ 13 St., Columbus, engrs.

O., Eastlake—Cleveland Electric Illuminating Co., Public Square, Cleveland, plans by Donald Y. Galer, c/o owner, power station, 8 turbo-generators, 1,000x1,200 ft., 300 ft. high boiler stacks, steel frame, brick, masonry constr. **$100,000,000**. Emery W. Rhoads, 1596 Mars St., Cleveland, consult. engr.

R. I., Newport—Pub. Wks. Dpt. Navy Dpt., Coddington Cove, power roof work, incl. install motor driven fan, ventilator, heating plant, carpentry, joinery, rig, electrical work, metal work. Spec. No. 35915. Plans deposit $10.

South Dakota — East River Electric Power Co-operative, Sioux Falls, rural distr. lines in eastern South Dakota to supply power to 21 different REA co-operatives. **$5,950,000**. Buell & Winters, 508 Insurance Exchange Bldg., Sioux City, consult. engrs.

Texas—Grayson-Collin Electric Co-operative, Van Alstyne, rural distr. lines, sys. imprvs., Grayson and Collins Counties. **$585,000**. Joe E. Ward, 545, Nacol Bldg., Fort Worth, consult. engr.—88.8 mi. rural distr. lines, incl. 78 mi. conversion. Grayson and Collin Counties. $75,000. Plans deposit $10. Joe E. Ward, 545 Nacol Bldg., Wichita Falls, engr.

Texas—Jasper-Newton Electric Co-operative, Kirbyville, 116 mi. rural distr. lines and sys. imprvs., Jasper Co. **$215,000**.

Texas—Brazos River Transmission Electric Co-operative, Inc., 902 Amicable Bldg., Waco, 37.8 mi. 69 kv H-frame rural distr.

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lines, Hamilton and Comanche Counties. $90,000.

Wyoming—Bureau Reclamation, Dpt. Interior, Casper, installing overhead ground wires on Seminole-Cheyenne 115-kilo-volt transmission line, Kendrick Proj., near Medicine Bow, Laramie and Cheyenne, Spec. No. DC-3289. Michael W. Straus, comr.; adv.

Low Bidders & Contracts Awarded

Colorado Springs, Colo.—Springsfield Boiler Co., 1901 E. Capitol St., Springfield, Ill. Contract Awarded, $433,887, steam generating unit of municipal electric plant, City, City Hall, Colorado Springs, Colo.

Ill., Joppa—Easco Services Inc., 2 Rector St., New York, N. Y., design and construct, $73,000,000. 500,000 kilowatt electric POWER PLANT to provide power for atomic energy project near Paducah, Ky., to be located on Ohio River near here. Electric Energy, Inc., c/o J. W. McAfee, pres., 315 N. 12 Blvd., St. Louis, 1, Mo.

Minn., Mountain Iron—Power Service Corp., 711 Wesley Temple Bldg., Minneapolis, Minn. Contract Awarded. $92,400, piping, auxiliary equip., electric equip., station wiring at municipal power plant, Village, Mountain Iron, Minn. A. Fiola, clk.

Mississippi—Alcorn Electric Power Assn., Corinth, Miss., rejected bids Nov. 28, 134.3 mi. rural distr lines, 2.2 mi. three-phase primary lines, 107.9 mi. single-phase primary lines, 10.03 mi. secondary lines, 10.07 mi. services, 2 mi. conversion single-phase to V-phase, 2.1 mi. conversion single-phase to three-phase, Alcorn Co. New bids Jan. 19.

Tex., Houston—City, City Hall, 900 Brazos St., Houston, Tex., Purchase and Hire, $110,000, expansion electric street signal lighting sys.

Wash., Tacoma—Westinghouse Electric Corp., East Pittsburgh, Pa., Low Bidders, $175,730, 15,000 kva unit substation for Nisqually power project. City, City Hall. J. F. Ward, city light supt.

Wash., Tacoma—Allis-Chalmers Mfg. Co., 1126 S. 70 St., Milwaukee, Wis., Contract Awarded. $183,830, 15,000-kva unit sub-station for Misqually power project, City, City Hall, Tacoma, Wash.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., San Diego—Dpt. Navy, 1220 Pacific Hy., San Diego, 3 story rein.-con. laboratory, supply and utility bldg. Approx. $200,000. Plans deposit $150.

Conn., Waterford—New England Steel Development Corp., c/o New England Council, Statler bldg., Boston, Mass., certificate of necessity granted, steel mill. $250,000,000.

Del., Newark—The Chrysler Corp., Highland Park, Mich., plans by Albert Kahn Associated Architects & Engineers Inc., 345 New Center Bldg., Detroit, Mich., mfg. plant and office, $5,000,000.

Kan., Lake City—U. S. Eng., Davidson Bldg., Kansas City, Mo., rehabilitation Lack City Ordnance Plant, $4,000,000.

Md., College Park—State, Dpt. P. Imprvts., 506 Park Ave., Baltimore, Zone 1, 4 story, concrete, steel, brick physics bldg. at University of Maryland, $800,000. Plans deposit $50. Hall, Border & Donaldson, 2517 St. Paul St., Baltimore, archts. Henry Adams, Inc., 2315 St. Paul St., Baltimore, mech. engr. L. P. Kooken Co., 2017 Maryland Ave., Baltimore, consult. engrs.

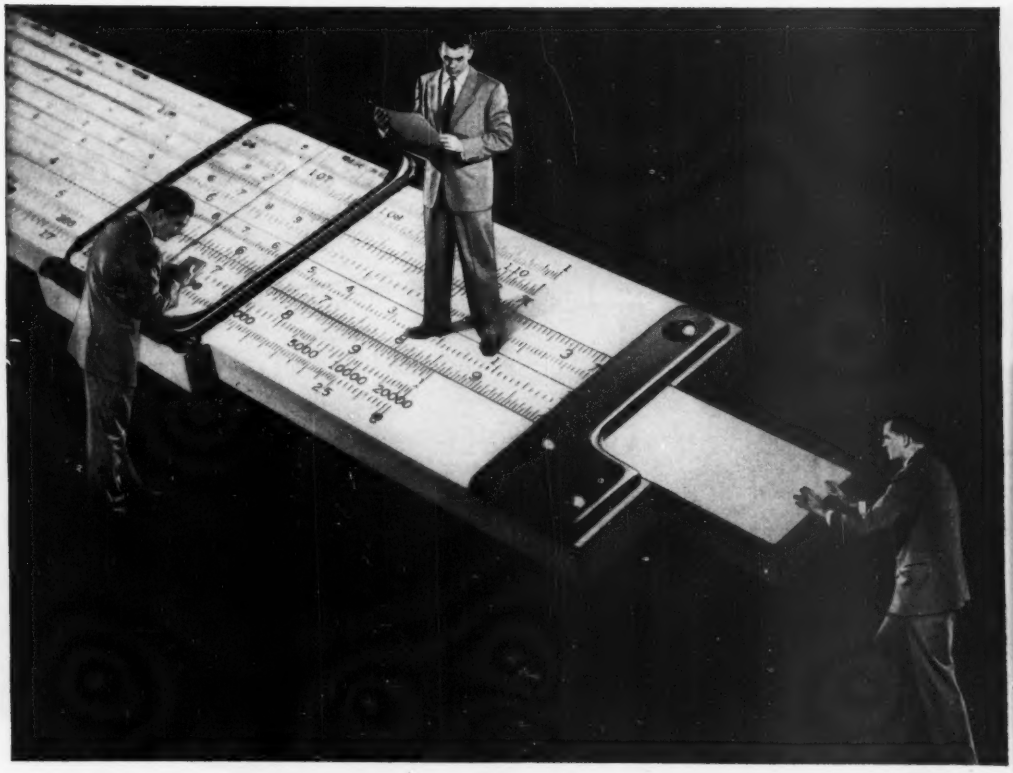
N. M., Alamogordo—U. S. Eng., P. O. Box 1538, Albuquerque, utilities, Phase III, driveways, Holloman Air Force Base (A-91). Serial No. Eng. 29-005-51-16. Plans deposit $10.

Mich., Detroit—City, County Bldg. Auth., Mayor Cobo, City Hall, plans by Harley, Ellington & Day, Inc., 153 E. Elizabeth St., bsmnt., sub-bsmnt., brick, steel, concrete business bldg., incl. bomb shelter. $16,000,000.

Tex., Waco—Hillcrest Memorial Hospital, 3000 Herring St., plans by Walter Cocke, Jr. & Co., 1507 Franklin St., 100-bed hospital addn. $850,000. Frank T. Drought, 117 W. Peacan St., San Antonio, consult. engr.

R. I., Johnston—Town Supt. of Schools, 80 Grenville Ave., brick, steel, concrete Junior High School. $1,435,000.

some problems demand special attention



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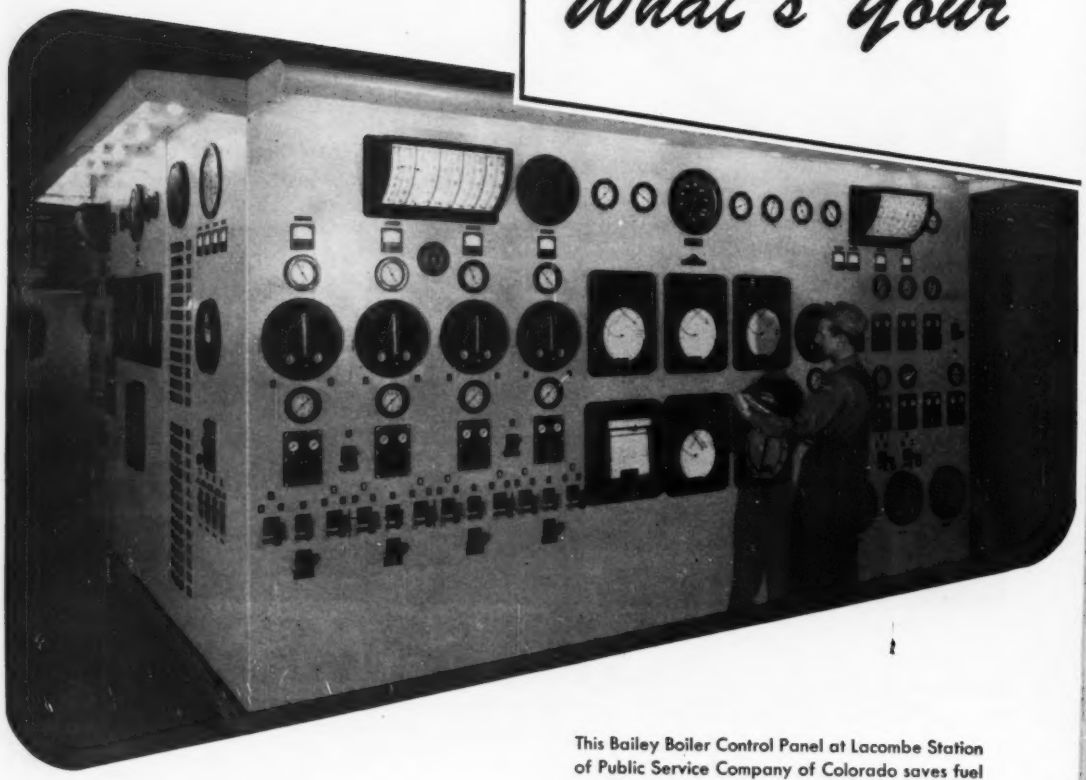

This Bailey Boiler Control Panel at Lacombe Station of Public Service Company of Colorado saves fuel and insures safe operation of a 350,000 lb per hr 850 psi, 900 F boiler fired by pulverized Colorado Lignite Coal and/or natural gas.

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TECHNICAL LITERATURE

Insulation Testing—Factors which affect or change insulation resistance characteristics are reviewed in AIEE Publication No. 42, *Recommended Practice for Testing Insulation Resistance of Rotating Machinery.* There are formulas, based on machine dimensions, for the calculation of approximate standard insulation resistance values for various types of rotating machinery. Uniform methods of making non-destructive insulation resistance tests are outlined. Inconsistencies of insulation resistance tests are pointed out. The recommendations apply to synchronous, induction, and dc machines, including synchronous converters. Price to members is 30¢ from American Institute of Electrical Engineers, 33 W. 39th St, New York, N. Y.

Temperature, Pressure Control—*The Control Story* is a booklet outlining in non-technical language the operations of automatic controls for heating, ventilating, and air conditioning, including electric controls. Copies may be obtained from Barber-Colman Co, Automatic Controls, Rockford, Ill.

Wire and Cable—General Catalog 490 covers not only the entire line of wire and cable products, but has much additional technical information concerning ASTM and ASA specifications and standards, NEC information, physical and electrical characteristics, sections on the properties of copper, aluminum, and insulation and jacket compounds. A special technical section contains details of many types of cable calculations, constants, conversion factors, properties of materials, and much other information. Information about the catalog may be secured from General Cable Corp, 420 Lexington Ave, New York, N. Y.

Fire Safeguards—Fire and explosion safeguards for industrial ovens are presented in a standard on *Class A Ovens and Furnaces.* They apply to ovens where explosive vapors may be produced from painted materials being dried or baked in the ovens, impregnated materials, etc. This 72-page pamphlet, No. 86, is priced at 75¢ from National Fire Protection Association, 60 Batterymarch St, Boston 10, Mass.

Speed Governing—Minimum functional and performance characteristics are in *Recommended Specification for Speed-Governing of Hydraulic Turbines Intended to Drive Electric Generators.* It applies to governors for impulse turbines, Francis turbines, fixed blade propeller turbines, and adjustable blade propeller turbines. Price of Publication 605, intended for trial use, is 30¢ to members of American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Power Relays—*American Standard for Relays Associated with Electric Power Apparatus* relates only to relays of types directly associated with power switchgear. Not covered are relays of types designed primarily for industrial control, excitation, or governor regulating, telephone, telegraph, traffic signal, etc. Definitions are given for classes of relays, 51 types of relays, and general terms. Standard C37-1-1950 may be secured for 30¢ from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Textile Materials—Information pertaining to the electrical field is found in the following sections of *ASTM Standards on Textile Materials:* Asbestos Roving for Electrical Purposes; Magnetic Rating of Asbestos Used for Electrical Purposes; Tapes, Cotton, Woven, for Electrical Purposes; Thickness of Solid Electrical Insulation; and others. Price of the 584-page book is $4.50 from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

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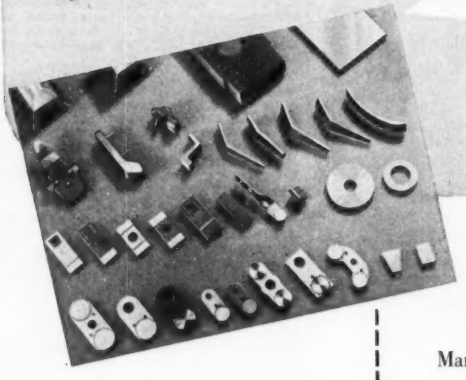

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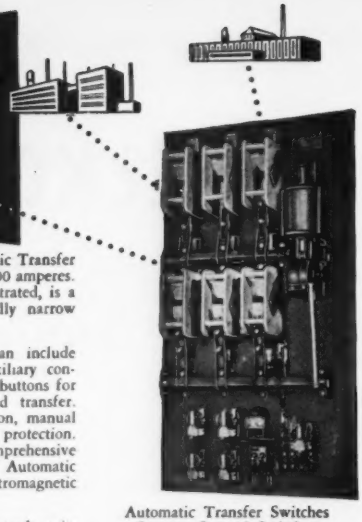

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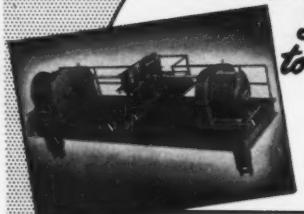

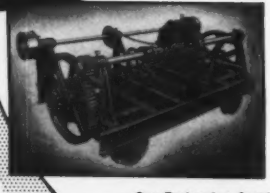

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CATALOGS • BULLETINS

● MOTORS: Detailed engineering information, construction features, frame sizes, and photographs of installations appear in Bulletin 605, "High-Speed Synchronous Motors & Generators," and Bulletin 650, "Wound-Rotor Induction Motor Control for Centrifugal Compressor Drives". The Ideal Electric & Mfg Co, Mansfield, Ohio.

● STANDBY POWER: Vol. 6, No. 3 is a special issue of "Power Points" showing photographs of hospitals in all sections of the country and views of standby electric generating plant installations. Mr. V. C. Gilbertson, D. W. Onan & Sons, Inc, University Ave at 25th S. E., Minneapolis 14, Minn.

● LUBRICATION PRACTICES: A folder gives use and application data for 25 different Lubriko densities ranging from liquid greases to heavy cup lubricants. There is lubrication maintenance and selection information. Master Lubricants Co, Meadow and Jackson Sts, Philadelphia, Pa.

● CATHODIC PROTECTION: "Cathodic Protection Testing Equipment" is a folder giving information about a soil bridge, "galvometer", combination soil resistivity rod and pipe prod, and a copper sulfate electrode for pipe-to-soil potentials. J. L. Collins, P. O. Box 944, Angleton, Tex.

● ELECTRON TUBES: A new manual presents data on gaseous discharge rectifier and control-rectifier tubes. There is information on ratings, circuits, applications, and life expectancy. Electrons, Inc, 127 Sussex Ave, Newark 4, N. J.

● HOISTS: Single-drum, multi-purpose hoists for construction jobs, industrial plants, mines, and oil fields are described in Bulletin 76-X. Specifications are given for hoists with capacities from 500 to 3,500 lb, including those driven by electric motors. There is also a selection chart. Joy Manufacturing Co, Oliver Bldg, Pittsburgh 22, Pa.

● FLYASH: Information on both hydraulic and pneumatic ash and flyash handling systems is offered in a new booklet compiled in question and answer form. The information appeared as a series in *Power* magazine. Beaumont Birch Co, 1505 Race St, Philadelphia 2, Pa.

● TOOL CRIB CONTROL: Bulletin A-510 presents step-by-step procedure to prevent theft, hoarding and loss of tools, gages, etc, loaned to employees. McCaskey Industrial Controls, 101 W. 31st St, New York 1, N. Y.

● DISCONNECTING SWITCHES: The complete line of Westinghouse indoor and outdoor air-disconnecting switches is described in an 8-page booklet, B4726. Highlights of the design and operation of these switches as well as application information to simplify selection are included. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

● STREET LIGHTING POLES: Catalog No. 78, 36 pages, is devoted to street lighting poles and pertinent engineering data. Nearly 500 design combinations are included, together with specification tables giving data on standard mounting heights, bracket spreads, and pole sizes available. The Union Metal Mfg Co, Canton 5, Ohio.

● COLD CATHODE LAMPS: A four-page folder, A-5010, contains descriptive material and engineering data on cold cathode fluorescent lamps and fixtures. Colonial Electric Products, Inc, East Paterson, N. J.

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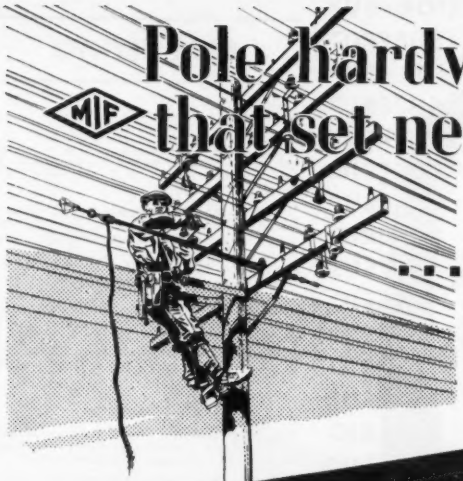

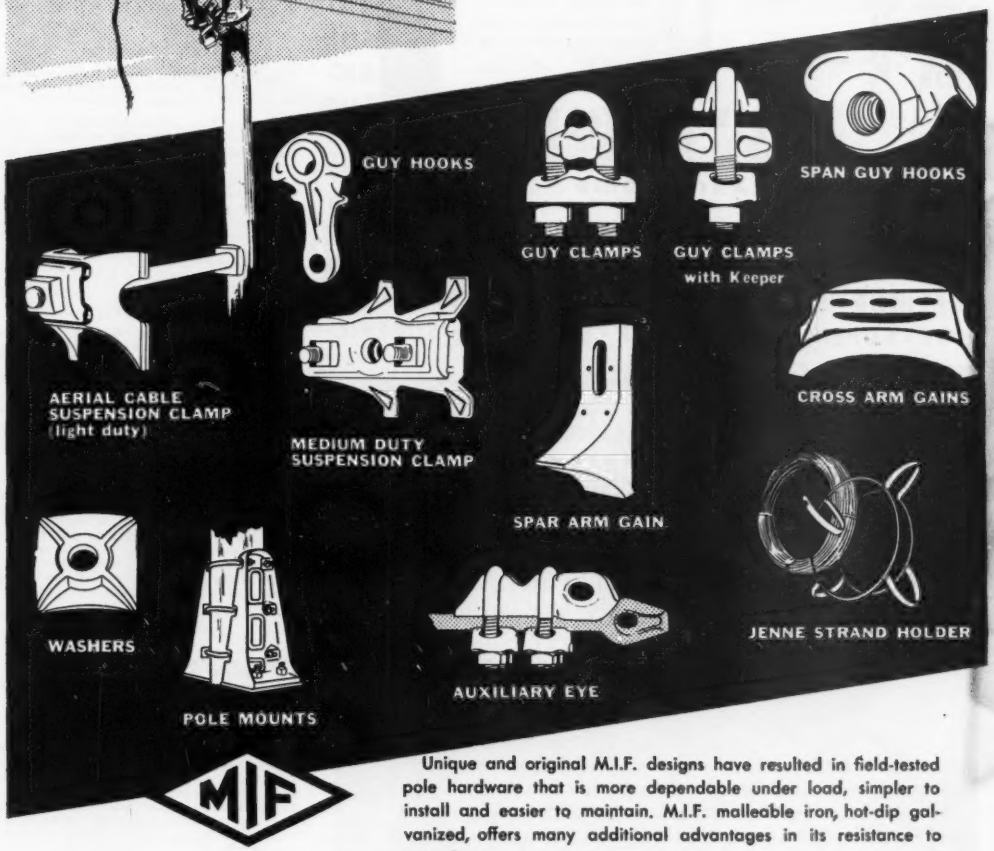

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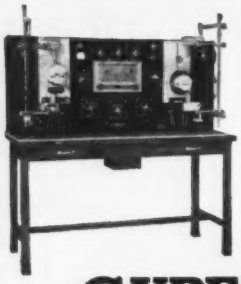

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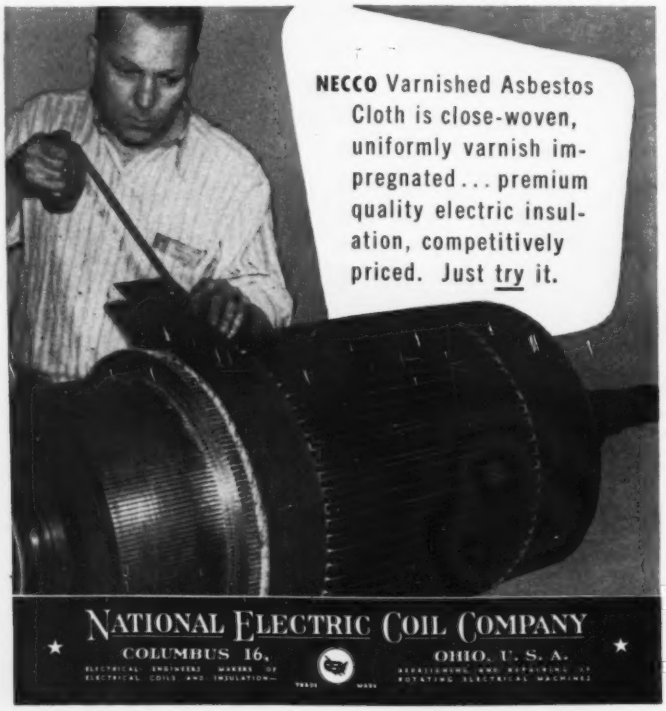
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BOOK REVIEWS

Apparatus Design

Design of Electrical Apparatus. **J. H. Kuhlmann and N. F. Tsang. Published by John Wiley & Sons, Inc., New York 16, N. Y. 512 pages, illustrated. Price $6.50.**

The third edition presents the quantitative design of dc motors and generators, synchronous machines, small ac motors and transformers. Difference from the second (1940) edition lies principally in adopting constants and limits in line with current practice in addition to new methods of calculating field currents, saturation and small transformer design. Sample calculations are given in extended detail. Symbol lists and wire tables are in a supplement carried in a cover pocket.

Plant Operation

Steam-Plant Operation. **By E. B. Woodruff and H. B. Lammers. Published by McGraw-Hill Book Co, N. Y. 18. 543 pages, illustrated. Price $7.**

To the first edition (1935) has been added the improvements in both equipments and techniques of maintenance and operation which denote the 15-year advances in the art. Welding, use of fuel oil, better combustion, refined controls along with turbine and auxiliaries are cases in point. Generally, however, the treatment is addressed to the operator of plants smaller than those prevalent in the utility industry.

Acoustics

Fundamentals of Acoustics. **By L. E. Kinsler and A. R. Frey. Published by John Wiley & Sons, Inc., New York 16. 516 pages, illustrated. Price $6.**

Power engineers are destined to become more conscious of noise as emitted by transformers, smokestacks (fan whine), turbines, etc. Here is a book for them carrying basically the mathematical analysis of acoustics in both music and sound. Discussion of transmission, resonance, absorption, traps and filter is followed by a chapter on psychoacoustics and another on architectural desiderata. Subject matter on refraction and magnetostriction cannot but be of interest to utility engineers engaged in reducing apparatus noise. Unfortunately there is comparatively little information about the art and tooling of acoustical instrumentation.

Transmission

Transmission Lines and Networks. **By W. C. Johnson. Published by McGraw-Hill Book Co., Inc., New York 18. 361 pages, illustrated. Price $5.00**

Noteworthy about this text is the successfully integrated handling of power and electronic phenomena. There is a short chapter dedicated exclusively to power lines but what makes the book significant to the power engineer is that single-phase circuits and coaxial lines, characteristic impedance and insertion loss, decibel attenuation and voltage decrease are discussed as related subjects. The major emphasis is, however, on the electronic sector and such segments of it as impedance switching, four-terminal networks and filter design.

Instruments and Measurements

Basic Electrical Measurements. **By M. B. Stout. Published by Prentice-Hall, Inc, N. Y. 504 pages, illustrated. Price $7.75.**

Basic in the title means that the text has been confined to resistance, current and voltage measurements and the instruments available for determining the values. Discussion starts with the evolu-

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tion of the fundamental units and the analysis of the degrees of accuracy and precision attainable. Specific techniques follow for bridges, potentiometers, galvanometers, inductance, capacitance, and Q; shielding, accessories, instrument transformers and magnetics. Closing chapters are devoted to indicating instruments. This scope excludes insulation resistance measurements and energy meters.

Atomic Power Costs

Economic Aspects of Atomic Power. **By S. H. Schurr and J. Marschak. Published by Princeton University Press, Princeton, N. J. 289 pages, illustrated. Price $6.00.**

Not even those who are striving to create a practical atomic power plant know what the outlay per kw will be or the cost in mills/kwhr of the generated energy. Here, however, is as informed an estimate as can be found because the authors (working under the Cowles Commission for Research in Economics) have documented their assumptions in thorough manner. In fact, the data are the synthesis of world expert opinion, leading to the conclusion that atomic energy at 10.2 mills from a $315/kw plant would match coal at $16.50 per ton. This prospective economy establishes its potentiality for aluminum, chemical, cement, glass and steel production as well as indicating the contribution uranium piles could make to economically backward countries where there is a deficiency in conventional fuels.

Domestic Water Heating

Domestic Water Heating: Basic Engineering Principles. **By Ronald Grierson. Published for "Electrical Review" by Iliffe and Sons Ltd, London, SE 1. 263 pages, illustrated. Price 25s.**

Besides setting out the principles of the subject, this book gives a critical analysis of current British practice in the supply of hot water for domestic purposes. The book deals mainly with the combination of an electric immersion heater and thermostat with a conventional hot-water storage tank, in conjunction with a coal- or coke-fired water heater, this being arranged either as a "back-boiler" or as an independent unit. The author contends that a suitably arranged installation of this type can be both economical and efficient, and disposes conclusively of the widespread notion that "Electric water heating is convenient but expensive." In addition, the book contains considerable reference to the factory-made, self-contained, storage type of electric water heater.

Television

Television Receiving Equipment. **By W. T. Cocking. Published by Iliffe & Sons, Ltd, London, SE 1. 375 pages, illustrated. Price 18s. net.**

The author is editor of "Wireless Engineer." His book is unusually instructive because he has taken each element of the set separately for the sake of explaining the functions and limits of each circuit component employed in it in the process of achieving deflection, detection, synchronizing, flyback, amplification and linearity compensation. Only then does he combine the segments to constitute a complete receiver. After that he discusses the antenna, interference and trouble shooting in the same analytical manner.

Nucleonics

Sourcebook on Atomic Energy. **By Samuel Glasstone. Published by D. Van Nostrand Co, Inc, New York 16, N. Y. 546 pages, illustrated. Price $7.90.**

Background of atomic energy has been accumulating almost since Dalton in 1808 established the atom. The literature is in the libraries of five continents. Here, however, a consultant of the Atomic Energy Commission acting under direction of the AEC has assembled the essence of all the intervening, pertinent physics in a terse and well organized manner. The dependence of fission upon the electron, proton, radioactivity, neutron, wave me-

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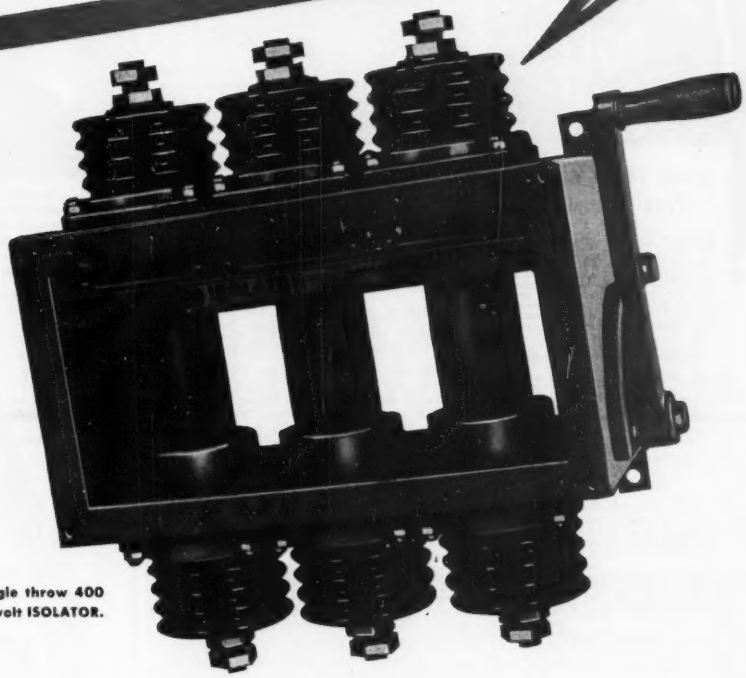

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Circuit Analysis

Circuit Analysis of AC Power Systems. Vol II. By Edith Clarke. Published by John Wiley & Sons, Inc., New York 16, N. Y. 396 pages, illustrated. Price $8.50.

In her 23 years at General Electric, the author won recognition for her penetrating mathematical analysis of power systems particularly under abnormal conditions. From this unique point of vantage she has constructed this college text at an equally unique level of practicality. The chapter on cables and conductors is particularly helpful in discussion of skin effect, spirality, proximity, stranding, sheath inductions, etc. Other chapters deal with transformers (including autotransformers and four-winding units), induction motors, synchronous machines. For the latter the alpha-beta-zero component technique is given in an ensuing treatment of system faults. Relay protection is evolved in terms of the impedances encountered under fault conditions.

Personnel Administration

Handbook of Personnel Forms and Records. By Eileen Ahern. Published by American Management Association, 330 West 42nd Street, New York 18, N. Y. 227 pages, illustrated, Price $3.50.

Forms and records used in every major activity of personnel administration are analyzed and illustrated. Most of the report is devoted to reproductions of selected forms currently in use in representative companies. The accompanying reading matter brings out the objectives of the personnel activity and the underlying principles governing its administration. The handbook provides a useful reference for personnel executives.

Wage and Salary Administration

Handbook of Wage and Salary Administration. By M. Joseph Dooher and Vivienne Marquis. Published by American Management Association, 330 West 42nd Street, New York 18, N. Y. 416 pages, illustrated, price $7.50 (AMA members, $5.00)

This handbook is designed to meet the needs of companies that contemplate setting up a formal program of wage and salary administration. It is an integrated compilation of the best material on wage and salary administration that the Association has published. As an entirely practical guide to the solution of current problems, it is an outstanding contribution to the field.

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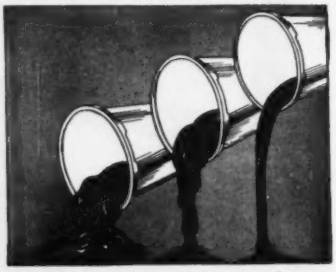

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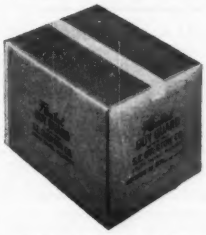

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1—	750	G.E.	900	275	4150
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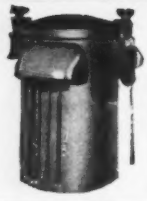

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150	G.E.	440	250
150	Al.Ch.	220	125
100	G.E.	440	250
75	Al.Ch.	440	250
75	Westg.	2300	110
60	Al.Ch.	2300	110
50	Westg.	220	110
40	Cr.Wh.	220	125
40	Al.Ch.	440	250
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300	*Westg.	CS	3600
300	G.E.	IE	1200
300	Westg.	CS	514
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250	L. Allis	1468	720
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35	Cr.Wh.	CM351	700
30	Westg.	SK120	875
30	G.E.	RC31B	1150
25	Westg.	SK106L	1100
25	Al.Ch.	E	700
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300	G.E.	IM	1800
250	Westg.	CW32B	900
200	G.E.	IM	600
150	Westg.(new)	CW772C	1200
125	G.E.	M6333	900
125	G.E.	M6334	720
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3	1000	West.	66000—7200
3	100	West.	44000—7200/12470Y
3	75	G.E.	44000—2300/4600
3	8333	West.	43800—13900
4	6667	G.E.	38100/66000Y—12700/22000Y
6	150	G.E.	34500—4600/2300
2	7500	A.C.	33000—13200, 3 ph.
1	5000	G.E.	33000—2300/4600, 3 ph.
3	500	West.	33000—2400/4160
3	333	G.E.	33000—460
6	200	G.E.	33000—2300/6900
6	75	Mol.	33000/16500—2300/6900
3	75	Weg.	33000—7200/12470 Y
1	7500	G.E.	26,400 Rectifier Type
4	450	A.C.	25410/44000—13280/23000
3	750	West.	13200—440
3	333	West.	13200—440
3	333	G.E.	11000/22000—2400
3	200	Mol.	11000—2300
1	1500	West.	4000—2300, 3 ph. Auto
3	500	G.E.	4000—2300
3	250	A.C.	2300—460

INDUCTION REGULATORS

1—150 KVA. G.E. 200 A. 4000 V. 3 ph.
3— 46 KVA West. 200/400 A. 2300 V.
6— 36 KVA G.E. 150 A. 2400 V.
3— 36 KVA G. E. 75/150 A. 4600 V.

CIRCUIT BREAKERS

4—400 A. 154 KV G.E. FHKO—39—2500MVA*
1—600 A. 132 KV G.E. FHKO—60—1500 MVA*
1—600 A. 73 KV G.E. FHKO—139—1000 MVA*
1—400 A. 73 KV G.E. FHKO—236—500 MVA*
1—600 A. 37 KV G.E. FHKO—139—450 MVA*
2—400 A. 37 KV G.E. FHKO—236—500 MVA*
4—600 A. 15 KV G.E. FHKO—139—750 MVA*
2—600 A. 15 KV West. B-28—B-500 MVA**

* Outdoor ** Indoor

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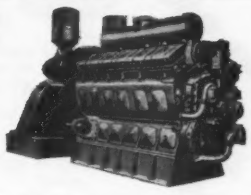

A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	D8G-6	450	450
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-12½x13T	750	600	187	Ingersoll Rand	S	225	514
425	Baldwin	VO-6	510	450	125	General Motors	3-268A	150	1200
400	Buskeye	80	480	600	75	General Motors	6043C	90	1200

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1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2400V
1—1000 KVA G.E., 3 Ph., 4150V 2 Ph., 2400V
3—667 KVA G.E., 1 Ph., 33,000V, 2300V Sec.
3—500 KVA Packard, 1 Ph., 2400V, 480V Sec.
1—500 KVA Kuhlman, 1 Ph., 4150V, 2300V
3—400 KVA G.E., 1 Ph., 6900V, 2300V Sec
3—250 KVA Maloney, 1 Ph., 13,800V, 240/480 Sec
1—75 KVA G.E., 3 Ph., 2400V, 240/480V Sec.
1—50 KVA G.E., 1 Ph., 13,450V, 120/240V Sec.

MOTOR GENERATOR SETS

2—1500 KW G.E., 600V, 600 RPM, 4000V Syn.
2—1250 KW G.E., 275V, 600 RPM, 4000V Syn.
1—1000 KW G.E., 600V, 514 RPM, 4000V Syn.
2—150 KW G.E., 125/250V, 1200 RPM, 4000V Syn
2—75 KW G.E., 250V, 1200 RPM, 220V Syn.

SLIP RING MOTORS

1—2500 HP G.E., MT. 257 RPM, 6600V
1—300 HP G.E., MT. 600 RPM, 440V

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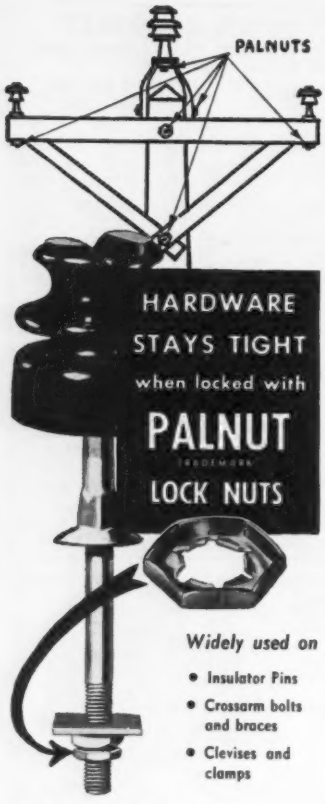

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LETTERS TO THE EDITOR

Which is Logical?

To the Editor:

Your editorial of November 20 (on Election Results) is one of very poor taste for any magazine endeavoring to win support for the trend of thinking it may desire to inculcate in the minds of its readers. But perhaps you do not desire to win new converts to your so-called private power interest but only to incense further and revitalize those promoting the developmeat of power only so far as immediate profit can be envisioned for themselves.

You can assert that there would seem to be men elected to the 82nd Congress who can be depended upon to protect private enterprise and stop at that. But you dare not assert that they might be trusted to protect monopolistic practice as the electrical industry has under private enterprise used in the past.

If adequate development of electrical power and distribution had been effected prior to the inception of government loans for electrical service to thousands of farms and huge harnessing development of our natural water supply for hydro-electric power—there would have been no need for such Act of Congress to do this developing so essential to our recent war efforts and everyday life.

You even assert socialism as a possible development under present trends, but New York State now having Mr. Dewey will see that "all the people" get hydro-electrically developed power.

That is interpreted as another innuendo of your intended active opposition to preference clauses now inserted by the Congress of the United States for groups or communities desiring to do their own business. These in our opinion make real private business.

Bernard R. Riley
Manager
McCook Electric Co-op
Salem, South Dakota

An Open Letter to Mr. Riley:

I was glad to receive your letter regarding the editorial appearing in the November 20 issue of Electrical World . . .

We do not believe that there should be any favored class of American citizenship. When the American tax dollar is spent for the development of natural resources, we believe that each American should be treated equally in receiving the benefits from that expenditure. A special group, whether they be members of an electric cooperative, citizens served by a municipal power system, or any other similar unit have no more right to receive the benefits than those customers supplied by a private power company. For after all, the so-called regulated monopolies operating electric utility systems have long been recognized as fundamental elements in the American system. We believe that any group of people in America has the right to organize any kind of association which they wish to supply their electric service. But we cannot believe that there should be two types of Americans, those who receive without giving and those who give without receiving the benefits of the American tax dollar.

Fischer Black
Editor
Electrical World
New York

Texas Whittlers

To the Editor:

Your December 25, 1950, News Issue, page 3, comments on the wire wrapping of wooden poles (as a protection against hungry horses).

"The order changeth"! A basic necessity to any trade was a pocket knife and a source of nice soft wood. Texas traders were destructive, but imagine how the chips flew when the Yankees were at work.

J. T. Deely
City Public Service Board
San Antonio 6,
Texas

(Editors Note: Only a Texan would find old-time Chesnut poles good whittling stock—and only a horse could eat one!)

INDEX TO ADVERTISERS
See Page 236

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